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NORTH AMERICAN SPECIES OF DERMEA [1]

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(WITH 57 FIGURES)

INTRODUCTION

In 1932, at the suggestion of Professor H. S. Jackson, the writer undertook the cultural study of life histories in the family Dermateaceae. The work was begun that year at the field laboratory of the Department of Botany, University of Toronto, at Bear Island, Lake Timagami, Ontario, and was continued there during succeeding summers, and at the University of Toronto until 1936. Since then it has been continued at the Division of Botany and Plant Pathology, Central Experimental Farm, Ottawa.

The aim at first was not primarily taxonomic but was to establish definitely by cultural technique the conidial relations of as many species of this group as could be collected and to make a comparative study of the conidial stages. However, as the work progressed, the importance of its bearing on the taxonomy of the group became increasingly apparent, and as an outgrowth of this work an attempt is now being made to bring together for the first time all the species of *Dermea* known in North America.

This study is based, for the most part, upon the writer's own collections and cultural studies, the specimens in the Mycological Herbarium of the Department of Botany, University of Toronto;

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the Mycological Herbarium of the Division of Botany and Plant Pathology, Science Service, Department of Agriculture, Ottawa; and the Farlow Herbarium, Harvard University. In addition, specimens have been loaned from the Durand Herbarium, Cornell University; the Mycological Herbarium of the New York Botanical Garden; and the Mycological Herbarium of the United States Department of Agriculture.

THE GENUS DERMEA

The genus *Dermea* includes a group of inoperculate Discomycetes characterized by the hard, leathery consistency, and the dark brown to black color of the apothecia, which are erumpent through the bark of twigs and branches and occasionally of main trunks of woody plants. The asci are cylindric to cylindric-clavate, and usually eight spored. The ascospores are ellipsoid-fusiform to ellipsoid, hyaline to yellowish-brown, and continuous to tri-septate. The paraphyses exceed the asci and their tips are more or less glued together forming an epithecium. Conidia that are generally elongate-fusiform to subfiliform, pointed at the ends, and more or less curved, occur in the life history. The conidial fruiting bodies may vary considerably in form in the different species. Microconidia are usually present and are hyaline, bacillar to filiform, and often more or less curved.

The above concept of the genus arose principally from the work of the Tulasnes (**1865**), who made careful field observations and remarkably accurate deductions concerning the conidial relationships of several species. They considered the type of the genus to be *Dermea Cerasi* (Pers. *ex* Fr.) Fr. This species is one of the most frequently collected and best known *Dermeae* and, as a result, the concept of this genus has remained relatively stable as compared to that of many other genera of Discomycetes.

Most authors have used the name *Dermatea* for this genus, and considered it to date from the treatment by Fries in the *Summa Vegetabilium Scandinaviae* 1849, but Seaver and Velasquez (**1933**) have drawn attention to an earlier work in which Fries proposed the name *Dermea* in essentially the same sense. In order to comply with the International Rules of Nomenclature it is necessary to adopt the earlier spelling, although *Dermatea* is much better

known, more euphonious, and more correct etymologically. However, because the attainment of stability in mycological nomenclature is most desirable, and since I am of the opinion that this can be best achieved by adherence to the Rules, even at the cost of temporary inconvenience caused by unfamiliar names, I have decided, somewhat reluctantly, to adopt the name *Dermea*.

According to Article 20 of the International Rules of Nomenclature, the nomenclature of fungi other than the Uredinales, Ustilaginales, and Gasteromycetes begins with Fries' *Systema Mycologicum* 1821–32. A difference of opinion exists among mycologists as to the interpretation of this rule. Some take the view that the starting point should be taken as 1821, others that the starting point for each group should date from its appearance in the Systema. The citations for certain species will vary according to the viewpoint adopted. For example, *D. Cerasi* will be *D. Cerasi* (Pers. *ex* Pers.) Fr. if the first view is adopted, but will be *D. Cerasi* (Pers. *ex* Fr.) Fr. if the second is adopted. In this paper the latter method of citation has been adopted, for this seems to me to be the interpretation called for by the Rules. I am of the opinion, however, that the adoption of 1821 as the starting point would tend to simplify problems of mycological nomenclature in general.

According to the interpretation adopted here, the nomenclature of the group begins with the *Systema Mycologicum* Vol. 2 published in 1822. In this volume Fries described several species of *Dermea* including *D. Cerasi* under the genera *Cenangium* and *Tympanis*. The name *Dermea* was proposed by Fries in the *Systema Orbis Vegetabilis* in 1825 on p. 114 [3] as follows:

> DERMEA (Baba). Perithecium suberoso-coriaceum cum strato discigero confluens, disco demum late aperto plano. Asci distincti, fixi, persistentes. Coloratae.
>
> Genus Pezizis maxime affine, H. 1. Pezizae coriaceae, erumpentes v. c. *P. tiliacea, furfuracea* &c. nec non *Cenangium Cerasi*. Disco firmo &c. Patellariam fere refert; a sequentibus ascis & sporidiis admodum distinctum apparet.

In the *Elenchus*, Vol. 2, 1828, in reviewing the Discomycetes, Fries dropped the genus *Dermea* but referred to it in the following note on page 20 under *Cenangium:*

[3] Seaver and Velasquez incorrectly gave the page citation as 343.

Aberrat. Cupula suberosa, discus plus nigrescens etc. in *C. Cerasi*, quod facile novi generis typus (*Dermea* S. O. V.), sed in praesenti distinguere superfluum duxi.

Finally in the *Summa*, p. 362, we find the following:

XXXV. Dermatea *Fr.* Pezizae et Cenang. sp.
Excipulum suberosum (coriaceumve in a), primo arcte clausum, dein ex urceolato expansum, disco (saturatius colorato) ascigero persistente, demum indurato.

a. *Encoelia.* coriaceae, ampliatae. *Midoti* affin.

1. *D. fascicularis.* S. M. II p. 75. 1–4. *S. S. 291. B. p. 191.*
2. D. fissa. *l.c.* 1, 2.
3. *D. furfuracea.* l. c. 1–3. *S. S. 457. W. n. 2. B. p. 182****)

b. *Dermateae genuinae*, suberosae. Tubercularii affin.

4. *D. tiliacea.* l. c. 1–3. *W. n.* 43
5. *D. Cerasi.* S. M. II. p. 179. 1–3. *S. S. 430. B. p. 211.*
6. D. Padi. *l. c.* β Lappon! Sph. fallax. *Wahl.!*
7. D. Prunastri. 3. W Goth.! P. Prunastri β A. S.
8. D. carpinea. (*Ehrh.*) 1. Scan. Tubercul. fascicul. *Tod.*
9. D. rubiginosa. *El. 2. p. 7.* 4. Alnus incana. *W. n.* 45.
10. D. purpurea. (*Hedw.*) 1. Ostrogoth.†) *W. n. 46.*

From the above it is evident that the choice of *D. Cerasi* as the type is correct according to the International Rules. It is one of the species mentioned in the *Syst. Orb.*, although not the first. However, Fries stated specifically in the *Elenchus* that he considered it to be the type. In the *Summa*, the first species mentioned under "Dermateae genuinae," *D. tiliacea*, should be considered an *Encoelia* as it is really closer to *D. fascicularis* than to *D. Cerasi*. The second species mentioned is *D. Cerasi*. Accordingly there is, therefore, no question that *D. Cerasi* can be accepted as the type of the genus. Moreover, in accordance with Article 18, Recommendation VI of the International Rules, the choice of *D. Cerasi* as the type fixes the generic name as it is commonly applied, a point that is of much greater importance to the establishment of a stable nomenclature than the original order in which the names were listed.

Upon the establishment of *D. Cerasi* as the type of the genus, the next step is to group around it those species which seem to be closely related and appear to form a phylogenetic unit. Most of the names in *Dermea* which have been based on North American material have been checked, and of the large number of fungi which

have been assigned to this genus at one time or another thirteen are considered to be true *Dermea* species. In addition, three new species are described, making a total of sixteen species recognized. Wherever possible European specimens have been examined and five species originally described from Europe have been recognized as occurring in North America. However, it has not been possible to check a number of species described from Europe and other continents.

THE CONIDIAL STAGE

One of the most interesting features of this genus is the variety of forms to be found in the conidial stage of the various species. The conidial fruiting body is essentially a stromatic structure containing a cavity in which the spores are produced. The stroma varies in form from an acervulus-like structure such as is found in *D. Hamamelidis* (FIG. 41) (and which might be referred to *Gloeosporium*), to a beaked pycnidium as in *D. Viburni* (FIG. 38) that has been placed in *Sphaerographium*. Other genera to which these conidial stages have been referred are *Micropera, Gelatinosporium, Sphaeronema, Phoma, Chondropodium, Cryptosporium,* and *Fusicoccum*. In culture all of the species tend to lose the characteristic shape of the fruiting body as found in nature, and form a more or less globose, fleshy stroma which develops one or more cavities in which spores are produced. This might be interpreted as the primitive or ancestral form of the conidial fruiting body in this genus, and the one from which the others have evolved. Among the conidial fruiting bodies as they occur in nature those of *D. balsamea* (FIG. 30) approach as closely as any to this primitive type.

This form was originally described as *Gelatinosporium abietinum* Peck, but there is no noteworthy difference between *Gelatinosporium* and the older genus *Micropera*. By a fortunate coincidence *M. Drupacearum* Lév., the type of the genus *Micropera,* is the conidial stage of *D. Cerasi,* the type of the genus *Dermea*. Therefore, I am of the opinion that, with the exception of *D. acerina* whose conidial stage is the type of *Naemosphaera* von Höhn., the conidial stages of all the species described here are best interpreted as belonging to *Micropera*. However, in this paper no at-

tempt has been made to name conidial stages which appear to be undescribed or to create new combinations in *Micropera* for those which have already been described under other generic names.

In contrast to the variability in the form of the fruiting body, the form of the conidial spore is remarkably constant. This is especially noteworthy in comparing the conidia produced in culture with those found in nature. In all of the species studied the size and shape of the conidia as produced in culture have agreed closely with those found in nature. The characters of the conidia are, therefore, very useful in species recognition, for they also exhibit characteristic differences in size and shape in different species.

It is, in fact, possible to arrange the species of *Dermea* into four more or less clear cut groups based on the size and shape of the conidia. Since each of the three species occurring on *Prunus* falls into a different group, and the fourth group consists of the single species, *D. acerina*, it is convenient to designate the groups by the names of the *Prunus*-inhabiting species as follows: the Cerasi group, the Padi group and the Prunastri group.

The Cerasi group is characterized by having conidia which are long, usually exceeding 35 μ in length, and sharply pointed at the ends. Six species may be included in this group, *D. Cerasi* (*Micropera Drupaceearum*, FIG. 42b), *D. molliuscula* (*Gelatinosporium fulvum*, FIG. 47b), *D. balsamea* (*G. abietinum*, FIG. 54b), *D. Peckiana* (*Micropera caespitosa*, FIG. 56b), *D. Libocedri* (FIG. 57b), and *D. Viburni* (*Sphaerographium hystricinum*, FIG. 49b). If the conidial fruiting body of *D. balsamea* is interpreted as the primitive type, those of *D. Cerasi* and *D. molliuscula* differ in having several cavities; *D. Peckiana* in having an excessive development of the basal stroma with several smaller cavities at the top; *D. Libocedri* as a somewhat reduced form in which the upper part of the stroma enclosing the cavity soon disappears; and *D. Viburni* as the most highly developed form consisting of a long-beaked pycnidium of definite form and more complex structure. The conidia differ somewhat in size and in the proportion of length to width in the different species. Those of *D. Viburni* are the most distinctive being typically much more pointed at one end than the other.

In regard to the characters of the perfect stage, the apothecia of the first three are large and conspicuous whereas in the latter

three they are much smaller; those of *D. Viburni* especially being much less conspicuous than the conidial fruiting bodies. The asci are similar in the first four species, but in *D. Libocedri* they tend to approach certain species of the Prunastri group in shape, and in *D. Viburni* they are more like those of the Padi group. It is evident that in most characters *D. Viburni* does not fit well into this group, but unless it is placed entirely by itself it seems to belong here better than in any of the other groups.

The Padi group includes the three species, *D. Padi* (*Micropera padina*, FIG. 44b), *D. bicolor* (FIG. 45b), and *D. Ariae* (*Micropera Sorbi*, FIG. 53b), in which the conidia rarely reach 35 μ in length and are usually much shorter, very narrow, and have sharply pointed ends. In this group the conidial fruiting bodies of *D. Ariae* are closest to the primitive form. Those of *D. bicolor* approach the multiloculate stroma of *D. Cerasi* whereas those of *D. Padi* are more definitely organized, cylindric to conic in shape, but scarcely beaked. The apothecia in all three species are small to medium sized with small, cylindric asci and small ascospores. Since the asci and ascospores of *D. Padi* are only slightly smaller than those of *D. Cerasi*, it is difficult to distinguish these two species on these characters. In the characters of the conidia, asci, and ascospores these three are very similar, but in color and consistency of the apothecia *D. Padi* and *D. bicolor* are like *D. Cerasi* whereas *D. Ariae* is more brownish and softer, approaching the Prunastri group in these respects.

The Prunastri group is characterized by having conidia which are relatively short, usually less than 40 μ in length, proportionately broader than in the other groups, and not as sharply pointed at the ends. It includes six species: *D. Prunastri* (*Micropera spuria*, FIG. 43b), *D. Hamamelidis* (FIG. 46b), *D. Tulasnei* (*Micropera cryptosporioides*, FIG. 55b), *D. Chionanthi* (FIG. 48b), *D. pinicola* (FIG. 51b), and *D. piceina* (FIG. 52b). The conidial fruiting body of *D. Hamamelidis* is the simplest found in the genus, consisting, as found in nature, of little more than a layer of conidiophores on a slight cushion of tissue. However, in culture the conidia are produced in a cavity in a more or less globose stroma as in other species so that it is probably best interpreted as a reduced form. The conidial fruiting bodies of *D. Tulasnei*, *D. Chionanthi* and *D.*

piceina are similar to the form here regarded as the primitive type, whereas in *D. Prunastri* we again find the beaked pycnidium. The conidial fruiting bodies of *D. pinicola* have not been observed in nature as yet.

The apothecia of this group are mostly small, softer in consistency, and more brownish in color than those of the other groups. However, *D. Prunastri* and *D. Hamamelidis* approach the Cerasi group in these respects. In general, the asci of this group tend to be proportionately broader and therefore more clavate than those of the other groups. Also, the ascospores are proportionately broader and more ellipsoid in shape. *D. Prunastri* is again an exception as its asci and ascospores are very similar to those of *D. Cerasi* and it is, in fact, almost impossible to distinguish these two species on these characters.

It is therefore evident that the three groups outlined above are not clear cut in the sense that the characters of the imperfect and perfect stages are correlated completely. In each group there are species which exhibit some of the characters of those in the other groups, and it is obvious that this would occur regardless of whether the grouping was made on the basis of some character other than the conidia. The use of the conidia as a basis for grouping the species does seem to bring together the more closely related forms.

The fourth group contains the single species *D. acerina* (*Naemosphaera acerina,* FIG. 50b) in which the conidia differ from all other species of *Dermea* in being oblong-ellipsoid. They are similar in shape to the conidia found in the closely related genus *Pezicula,* and this raises the question of what constitutes the distinction between *Dermea* and *Pezicula.*

The habit of growth is similar in both genera, all the species being erumpent through the bark of twigs and branches of woody plants. All of the leaf-inhabiting species of which I have seen material may be definitely excluded from these genera, and probably all leaf-inhabiting species should be so excluded. In *Pezicula* the apothecia are typically bright colored, yellowish to ochraceous, and softer in consistency, i.e. more fleshy-waxy than the leathery *Dermeae.* In *Pezicula,* also, the asci are usually proportionately

broader and more clavate and the ascospores more broadly ellipsoid to oblong-ellipsoid or ovoid. Correlated with these differences are the oblong-ellipsoid conidia found in species of *Pezicula* as contrasted with the elongate-fusiform to subfiliform conidia found in species of *Dermea*.

In color and consistency *D. acerina* is typical of the genus, in fact it is darker and tougher than *D. Tulasnei*. The asci and ascospores approach the *Pezicula* type to some extent, but not more than other species in the Prunastri group, for example, *D. piccina*, *D. pinicola*, *D. Chionanthi*, and *D. Tulasnei*. It is, therefore, only in the shape of the conidia that this species shows a striking difference from other species of *Dermea*.

Another species which occupies a somewhat intermediate position between the two genera is *Pezicula Frangulae* (Pers. *ex* Fr.) Fckl. occurring on *Rhamnus* with the conidial stage *Cryptosporiopsis versiformis* (Alb. & Schw.) Wollenw. In gross appearance dried specimens of this species strongly suggest *Dermea* but, on moistening, they become lighter colored with a consistency like *Pezicula*. The asci are similar in shape to those of *D. acerina* but are, of course, distinctive in being four spored. Both the ascospores and conidia are oblong-ellipsoid as in *Pezicula*. Thus, in this species the majority of the characters seem to indicate a closer relationship to *Pezicula* than to *Dermea*. I have not seen this fungus in the fresh condition or studied it in culture, but Wollenweber (**1939**), who cultured it, concluded that it belonged in *Pezicula*.

Finally, the species described as *Pezicula alnicola* by Groves (**1940**) should be mentioned. Its apothecia are typical of *Pezicula* in color and consistency, but the conidia are of the elongate-fusiform to subfiliform type, and the asci and ascospores are more *Dermea*-like in shape than those of *D. acerina*.

On the basis of this information it is evident that it is impossible to draw a sharp dividing line between these two genera. Here, as in other groups of Discomycetes, the generic position is not determined solely by one character but rather by the sum total of characters, and there are a few species whose generic position remains more or less a matter of opinion.

METHODS

Whenever possible, this study has been based on living material. Of the sixteen species recognized, fifteen have been studied in the fresh condition and I have personally collected thirteen of them. Morphological studies have been made from crushed mounts and freehand sections either in water, lactophenol containing dilute cotton blue, or phloxine in KOH.

Cultures were obtained from both ascospores and conidia whenever possible. Ascospore cultures are readily obtained by fastening an apothecium to the lid of a Petri dish with a drop of agar and allowing it to discharge spores on to the agar below. Single ascospore cultures of some species were made, but for the most part mass ascospore cultures were used. If fresh apothecia in good condition are chosen it is very seldom that any trouble is experienced with contaminations. As a further check tissue cultures from the interior of the apothecia were sometimes made, but usually only ascospore cultures were attempted.

In obtaining cultures from conidia the simplest method is to place the twigs in a moist chamber over night and then to pick off a fresh spore mass with a sterile needle. This can either be transferred to sterile water and loopfuls used to pour dilution plates, or the spores may be transferred directly to a tube of cooled, melted agar which is rotated to distribute the spores and then poured immediately into a Petri dish. If the twigs are not allowed to become watersoaked and freshly produced spore masses are chosen, pure cultures can be obtained without difficulty.

Cultures were grown on potato dextrose agar and on malt extract agar. Both media proved satisfactory, but on potato dextrose agar there was some tendency to produce excess mycelium and fewer conidial fruiting bodies. Accordingly, two per cent malt extract agar was used throughout.

Cultures were also grown on sterilized twigs of the host. Twigs were cut into lengths of 8–10 cm., a slit was cut in the bark at one end, and they were placed in 250 cc. or 300 cc. Erlenmeyer flasks with 25–30 cc. of water and sterilized in the autoclave at 15 lbs. pressure for 30 minutes. When cool they were inoculated by placing bits of agar and mycelium in the slit which had previously

been cut in the bark. Some flasks were stored in the laboratory at room temperature in diffuse light, others were kept in the greenhouse shaded from direct sunlight, and others were kept in the dark in a refrigerator at about 15° C. Conidial fruiting bodies were produced under all these conditions.

The study of living material furnished a basis for species concepts which proved to be invaluable in the interpretation of dried specimens, on which identifications must finally rest. Identifications have been made by comparison with types when possible or by comparison with exsiccati and published descriptions. The species of this group retain their characters well when dried and satisfactory preparations can be obtained from dried material by boiling apothecia or bits of the hymenium for about thirty seconds and then making a crushed mount in lactophenol containing dilute cotton blue.

CULTURAL STUDIES

Of the sixteen species described in this paper, all but one have been studied in culture. Twelve species have been cultured from both ascospores and conidia, one from ascospores only, and two from conidia only. In *D. pinicola* I failed to find the conidial stage in nature although it undoubtedly occurs, for cultures from ascospores gave rise to conidial fruiting bodies with conidia of the typical *Micropera* type. I have never collected *D. Padi* or *D. Libocedri* and in the specimens I received the apothecia failed to discharge spores. However, the nature of the association between the apothecia and the conidial fruiting bodies, and the similarity between these and the conidial stages of other *Dermea* species, leave little doubt concerning the genetic connection.

Only one species, *D. Chionanthi,* has not been seen in the fresh condition and has not been studied in culture. But in this species also a conidial stage of the *Micropera* type was observed closely associated with the apothecia in dried specimens, and it seems a reasonable assumption that this is the conidial stage.

In order to prove the genetic connection between the perfect and imperfect stages it would be desirable to complete the life history in culture using cultures originating from both ascospores and conidia. *D. balsamea* is the only species in which this has been

achieved. Apothecia were produced on sterilized twigs of both *Abies* and *Tsuga* in cultures originating both from ascospores and from conidia. However, in the other species it was considered sufficient evidence to establish the connection when cultures from both ascospores and conidia produced the same conidial stage in culture. It was observed that the form of the conidial fruiting body as produced in culture frequently differed considerably from the form found in nature but the conidia usually agreed closely in size and shape with those occurring naturally.

As well as providing evidence for the connection between perfect and imperfect stages, cultures have been of great assistance in the identification of species. For example, *D. bicolor* was first collected in the Timagami Forest Reserve in 1935 on an unidentified branch lying on the ground, but the fungus was not recognized and was carried in culture as an unknown *Dermea* until 1941 when the species was identified from a collection made at the Petawawa Forest Experiment Station and known to be on *Amelanchier*. The similarity in the cultures from the two collections led to the identification of the earlier Timagami specimen.

There has also been some confusion concerning the identity of the three species of *Dermea* occurring on *Prunus*. These are not always easily distinguished by their apothecial characters, but they can be readily distinguished in culture. Cultures of *D. Cerasi* on malt extract agar reach a diameter of about 2–3 cm. in four weeks. The colonies are white to pale buff with short, fluffy, aerial mycelium. Cultures of *D. Prunastri* grow at about the same rate or somewhat more slowly. However, they are compact, fleshy, more or less heaped up and radially furrowed, variously colored—olive to greenish, yellowish, or brownish—with short, velvety, aerial mycelium. Cultures of *D. Padi* are similar to those of *D. Cerasi* in gross appearance, but they can be distinguished at once by the much smaller conidia.

Other species in which the cultures are more or less brightly colored, varying from olive to yellowish, greenish, or brownish, are *D. Ariae, D. molliuscula,* and *D. piceina.* In *D. acerina* the cultures are usually bright green with a fluffy aerial mycelium but some cultures are brownish and lack the aerial mycelium.

As would be expected, in all of the species there are variations

in the cultural characters of different isolates and in the same isolates under different conditions, which make it difficult to describe them precisely in terms which would enable others to recognize them. However, conidia are usually produced readily in culture and these, combined with the appearance of the cultures, will enable the species to be identified. For example, the conidia of *D. Ariae* and *D. bicolor* are very similar but the cultures are quite distinct. On the other hand cultures of *D. bicolor* somewhat resemble those of *D. Peckiana,* but the conidia are very different.

In some species the cultures are sufficiently distinct to enable recognition of the species from their gross appearance. In *D. Viburni* the brownish, soft, fleshy cultures with irregular, lacerate margin, and almost no aerial mycelium are quite different from any of the other species. In *D. Hamamelidis* the cultures are very slow-growing, heaped up and usually deeply furrowed, tough, fleshy in consistency, whitish to brownish in color and with almost no aerial mycelium.

Although in most of the species the cultures are more or less distinctive, I consider their characters to be of secondary importance in distinguishing species of *Dermea.* Chief reliance should be placed on the characters of the asci, ascospores, conidial fruiting bodies, and conidia.

HOST RELATIONS AND PARASITISM

The evidence presented in this study indicates that the species of *Dermea* are, in general, specific to host. Only two species have been collected on plants belonging to more than one genus. *D. balsamea* has been collected on both *Abies* and *Tsuga,* and *D. Peckiana* on both *Ilex* and *Nemopanthus.* Seaver and Velasquez (**1933**) reported *D. molliuscula* on both *Betula* and *Alnus* but I have seen no material on *Alnus.* A knowledge of the host on which a specimen was collected is, therefore, of great assistance in identification. It is also desirable, in collecting species of this group, to include some of the wood of the host in order that its identity may be checked in cases of doubt.

Very little is known concerning the parasitism of most species, but it would seem probable from their host specificity and their

habitat on recently killed twigs and branches that they are at least weakly parasitic. Dodge (**1932**) has shown that *D. balsamea* was the cause of a die-back of hemlock, and Dowson (**1913**) has shown that *D. Prunastri* was the cause of a die-back of greengage plums. Possibly under favorable conditions some of the species might be capable of causing damage, but the indications are that in general they are not of great economic importance.

TAXONOMY OF THE GENUS DERMEA

GENERIC DIAGNOSIS

Dermea Fries, Syst. Orb. Veg. p. 114. 1825.
Cenangella Sacc. Consp. Gen. Disc. p. 9. 1884.

Apothecia erumpent, separate or cespitose, circular to undulate, sessile or narrowed below to substipitate, dark brown to black, hard, leathery in consistency, softer and more fleshy when moist; asci cylindric-clavate, mostly eight spored, ascospores ellipsoid to ellipsoid-fusiform, hyaline to yellowish-brown, one to several celled, paraphyses numerous, filiform, exceeding the asci and forming an epithecium; conidial fruiting bodies of various form; conidia mostly elongate-fusiform to subfiliform, pointed at the ends, more or less curved, hyaline, one to several celled; microconidia hyaline, bacillar to filiform, straight or curved, one celled.

TYPE SPECIES: *Dermea Cerasi* (Pers. *ex* Fr.) Fr.

KEY TO SPECIES

1. Apothecia reaching more than 1.5 mm. in diameter.....2
1. Apothecia less than 1.5 mm. in diameter.....4
2. Asci mostly less than 13 μ in diameter, conidia mostly less than 60 μ in length, on *Prunus*.....1. *D. Cerasi*
2. Asci mostly more than 13 μ in diameter, conidia mostly more than 60 μ in length.....3
3. Apothecia more than 1 mm. in height, conidial fruiting bodies usually more than 1 mm. in diameter, conidia less than 4 μ in diameter, on *Betula*.....2. *D. molliuscula*
3. Apothecia less than 1 mm. in height, conidial fruiting bodies less than 1 mm. in diameter, conidia more than 4 μ in diameter, on *Abies* and *Tsuga*. 3. *D. balsamea*
4. Asci four spored, apothecia yellowish when fresh, on *Rhamnus*. *Pezicula Frangulae*
4. Asci eight spored.....5
5. Ascospores less than 5 μ in diameter.....6

5. Ascospores more than 5 μ in diameter....9
6. Conidial stage conspicuous as beaked pycnidia, on *Viburnum*. 6. *D. Viburni*
6. Conidial stage not beaked pycnidia....7
7. Asci mostly more than 10 μ in diameter, on *Nemopanthus* and *Ilex*. 4. *D. Peckiana*
7. Asci less than 10 μ in diameter....8
8. Apothecia black, asci usually less than 75 μ in length, rarely exceeding 80 μ, on *Amelanchier*....8. *D. bicolor*
8. Apothecia brownish, asci usually exceeding 75 μ in length, on *Sorbus*. 9. *D. Ariae*
9. Conidial stage conspicuous as beaked pycnidia....:10
9. Conidial stage not beaked pycnidia....12
10. Conidia oblong-ellipsoid, on *Acer*....16. *D. acerina*
10. Conidia elongate-fusiform....11
11. Conidial fruiting bodies usually single, conidia less than 4 μ in diameter, sharply pointed at ends, on *Prunus*....7. *D. Padi*
11. Conidial fruiting bodies usually cespitose, conidia exceeding 4 μ in diameter, on *Prunus*....15. *D. Prunastri*
12. On coniferous hosts....13
12. On frondose hosts....15
13. Ascospores mostly less than 14 μ in length, on *Picea*....14. *D. piceina*
13. Ascospores mostly exceeding 14 μ in length....14
14. Ascospores 13–18 × 4–7.5 μ, conidia less than 50 μ in length, on *Pinus*. 13. *D. pinicola*
14. Ascospores 15–20 × 6–8 μ, conidia mostly exceeding 50 μ in length, on *Libocedrus*....5. *D. Libocedri*
15. Asci less than 15 μ in diameter....16
15. Asci mostly exceeding 15 μ in diameter....17
16. Apothecia small, scarcely reaching 1 mm. in diameter, conidia exceeding 4 μ in diameter, on *Hamamelis*....10. *D. Hamamelidis*
16. Apothecia larger, reaching 1 mm. or more in diameter, conidia less than 4 μ in diameter, on *Prunus*....7. *D. Padi*
17. Asci 14–18 μ in diameter, ascospores mostly 15–20 × 6–8 μ, on *Fraxinus*. 12. *D. Tulasnei*
17. Asci 15–20 μ in diameter, ascospores 18–25 × 7–9 μ, on *Chionanthus*. 11. *D. Chionanthi*

1. DERMEA CERASI (Pers. *ex* Fr.) Fr. Syst. Orb. Veg. p. 115. 1825. (FIGS. 1, 2, 27, 42.)

Peziza Cerasi Pers. Tent. disp. meth. fung. p. 35. 1797.

Cenangium Cerasi Fries, Syst. Myc. **2**: 179. 1822.

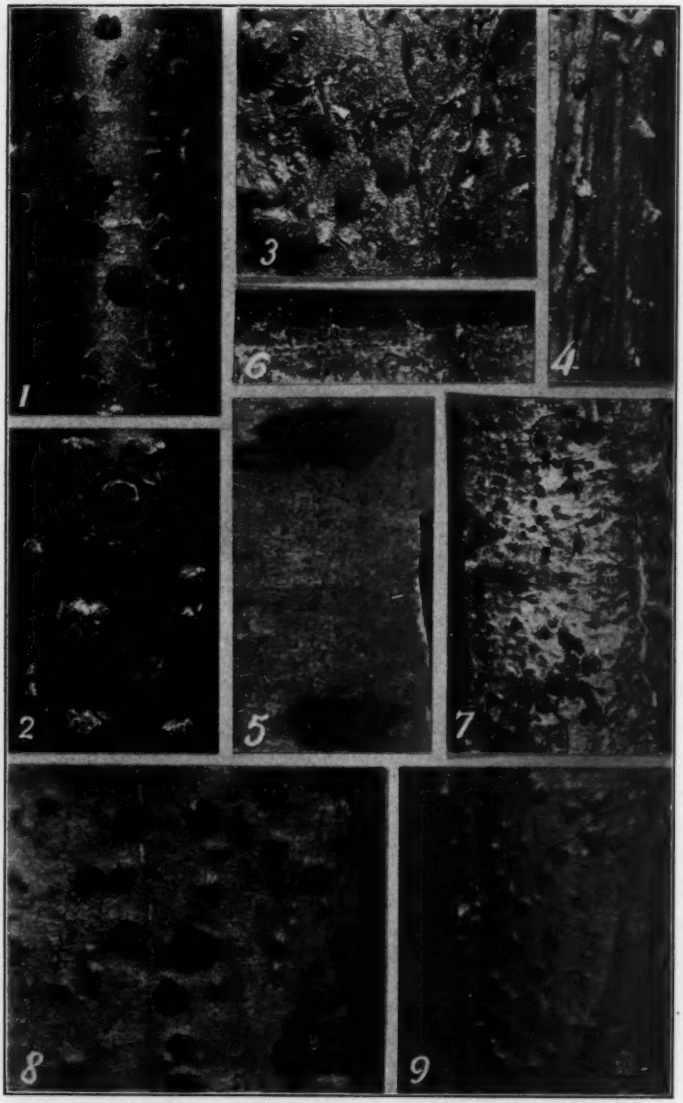
Cycledum Cerasi Wallr. Flor. crypt. Germ. **2**: 512. 1833.

Tympanis Cerasi Quél. Enchir. Fung. p. 330. 1886.

St. conid.

Micropera Drupacearum Lév. Ann. Sc. nat. III, **5**: 283. 1846.

Micropera Cerasi Sacc. Myc. Ven. p. 160. 1873.



FIGS. 1–9. Species of *Dermea*.

Micropera Cerasi Bon. Abh. Nat. Gesells. Hall. **8**: 133. 1864.
Micropera roseola Lév. Ann. Sc. nat. III, **5**: 283. 1846.
Sphaeria dubia Pers. Ic. Pict. Fung. fasc. **4**: p. 48, t. 20, f. 1. 1806.

Apothecia erumpent, gregarious, separate or sometimes cespitose, with few in a cluster, sessile, narrowed below, circular to undulate, 1.0–3.0 mm. in diameter and up to 1.5 mm. in height, at first brownish to yellowish-brown, furfuraceous, finally black and glabrous, hard, leathery to horny in consistency, becoming more fleshy-leathery when moist; hymenium at first concave, becoming plane or convex, roughened, sometimes cracked, occasionally slightly umbilicate, black, olivaceous to greenish when moist, margin at first thick, raised, furfuraceous, finally glabrous and disappearing, openings of the pycnidial cavities often appearing as yellowish wrinkles around the margin; tissue of the basal stroma composed of closely interwoven hyphae with elongated cells about 8 μ in diameter, hyaline to brownish, thick walled, often with host cells intermingled, tissue very compact below, often looser above and the cell walls thinner and darker, frequently with intercellular spaces, toward the outside the cells almost isodiametric, arranged in more or less obliquely parallel rows; subhymenium a narrow zone of closely interwoven, slender hyphae; asci cylindric-clavate, tapering below into a short stalk, eight spored, (75)90–120(150) × 10–13 (15) μ; ascospores ellipsoid-fusiform, hyaline to yellowish-brown, straight or slightly curved, one to four celled, irregularly biseriate, (12)15–20(25) × (4)5–7.5 μ; paraphyses hyaline, filiform, septate, simple or branched, 1.5–2.0 μ in diameter, the tips slightly swollen up to 4 μ and glued together forming a yellowish epithecium.

Conidial fruiting bodies erumpent, gregarious, very irregular in shape, circular or elongated, rounded irregularly to conical, 0.5–2.0 (3.0) mm. in length, 0.2–1.0 mm. in height, whitish to yellowish, pruinose to furfuraceous, surface wrinkled, soft, waxy, brittle, becoming more fleshy when moist, usually containing several flask-shaped, more or less lobed cavities which open irregularly and sometimes widely; tissue similar to the basal stroma of the apothecia, composed of closely interwoven, hyaline hyphae, toward the outside the cells shorter and darker, and around the cavities arranged in parallel rows; conidiophores hyaline, cylindric, septate, simple or branched, tapering to a slender tip, 10–25 × 2.0–2.5 μ; conidia elongate-fusiform to subfiliform, sickle-shaped or sigmoid to almost straight, ends pointed, hyaline to faintly greenish, one or two celled, (35)40–60(65) × 2.5–4.5 μ; microconidia hyaline, filiform, almost straight or curved, one celled, 12–23 × 1.0–1.5 μ.

HOST: *Prunus* spp. *P. avium* L.; *P. Cerasus* L.; *P. emarginata* (Doug.) Walp.; *P. nigra* Ait.; *P. pennsylvanica* (L.) f.; *P. serotina* Ehrh.; *P. virginiana* L.

EXSICCATI: Moug. & Nestl. Stirp. crypt. Vog. *494;* Rab. Fung. Eur. *1023;* Fuckel, Fung. Rhen. *1127;* Vize Micro-fung. Brit. *386;* Cooke, Fung. Brit. *659;* All. & Schn. Fung. Bav. *263* (*D. Padi*); Roum. Fungi Sel. Gall. Exs. *265, 931* (*Micropera Cerasi* f. *minor*), *887* (*Micropera roseola*), *1130* (*Micropera Cerasi* f. *major*), *3173* (*Dermatea Cerasi* f. *pycnidifera*); *Fungi Columb. 4942;* Ellis, N. Am. Fungi *40* (*Micropera Drupacearum*), *2812;* Shear, N. Y. Fungi *94;* Rel. Farl. *113;* Sacc. Myc. Ital. *673.*

SPECIMENS EXAMINED:[4] CANADA: **Nova Scotia:** Glenmont; DAOM *4630,* F; DAOM *4632;* DAOM *4635;* DAOM *4851;*—Colchester Co., JWG *797 ex* LEW *1753.*—**Quebec:** Cacouna, DAOM *3430,* JWG *135,* F;—Duchesnay, DAOM *5315,* JWG *603;* JWG *597;*—Ile Jésus, DAOM *7682;*—Tenaga, DAOM *5743;*—Lennoxville, DAOM *12050,* JWG *775;*—Ile Perrot, F;—St. Elzéar, DAOM *3800;*—St. Alphonse de Caplan, DAOM *3794,* F; DAOM *3780,* F.—**Ontario:** Timagami Forest Reserve, T *4385,* JWG *8;* JWG *28;* JWG *29;* T *4376,* JWG *60;* T *6574,* JWG *172;* JWG *241;* DAOM *2519;* JWG *493;*—Toronto, T *4383,* JWG *1;* T *4384,* JWG *3;* JWG *4;* T *4540,* JWG *75;* T *4534,* JWG *80;* T *4533,* JWG *86;*—Aurora, T *7206,* JWG *96;* T *4458,* F;—Forester's Falls, T *4842,* DAOM *3318,* JWG *122;*—Petawawa For. Exp. Stn., DAOM *4705;*—Ottawa, DAOM Macoun *94;* DAOM Macoun *329;* Lake Rosseau, F. Harper *589.*—**British Columbia:** Hastings, DAOM Macoun *35.*

UNITED STATES: **Maine:** Greenville, F;—Eastport, F.—**New Hampshire:** Chocorua, F, Aug. 1918; F, Sept. 28, 1906; Shelburne, F, Sept. 1893; F, Thaxter *4427;*—Intervale, F, Thaxter *3728;*—Glen Ellis, F.—**New Jersey:** Willsboro Pt., F *ex* USDA *1380.*—**Maryland:** Brookmont, JWG *694.*—**New York:** Ithaca, JWG *234;* F, Aug. 7, 1934, W. W. Ray;—E. Galway, F;—Alcove, F *ex* USDA *64103.*—**Pennsylvania:** Potter Co., DAOM *5376;* F, Shear *4192;* F, Shear *4198.*—**Michigan:** Ann Arbor, JWG *576;*—Atlanta, F, April 9, 1929, D. V. Baxter.

EUROPE: **Austria:** T, F *ex* Barbey-Boissier *1117;* T *ex* Barbey-Boissier *1118.*—**Belgium:** F *ex* Herb. Crypt. Belg. *1849.*—**England:** F *ex* Cooke Herb.—**Hungary:** F, DAOM, Magyar Flora *90;* F.—**Sweden:** DAOM unnumbered.

[4] In listing the specimens examined the aim is to give sufficient data for the collections to be recognized by other workers. The collections are arranged geographically and cited by herbarium numbers when possible. The herbaria are indicated by code letters as follows: DAOM—Mycological Herbarium of the Division of Botany and Plant Pathology, Central Experimental Farm, Ottawa; T—University of Toronto Herbarium; F—Farlow Herbarium; NYBG—Herbarium of the New York Botanical Garden; USDA—Mycological Herbarium of the U. S. Department of Agriculture; LOO—L. O. Overholts; LEW—L. E. Wehmeyer; JWG—J. W. Groves. Different collections are separated by semicolons, duplicate collections by commas.

A number of species of *Dermea* on *Prunus* have been described and some confusion has arisen concerning their identity. Cultural studies have shown that it is possible to distinguish at least three species in North America. The characters which most clearly separate them are the size and shape of the conidia.

They have been identified as *D. Cerasi* (Pers. *ex* Fr.) Fr., *D. Prunastri* (Pers. *ex* Fr.) Fr., and *D. Padi* (Alb. & Schw. *ex* Fr.) Fr. In *D. Cerasi* (FIG. 42b), the conidia are mostly 40–60 × 2.5–4.5 μ, and sharply pointed at the ends. The conidial fruiting bodies consist of fleshy stromata usually containing several cavities, and the apothecia are large, usually exceeding 1 mm. and frequently more than 1.5 mm. in diameter. They usually occur in clusters. In *D. Padi* (FIG. 44b), the conidia are similar in shape to those of *D. Cerasi* but much smaller, 20–30 × 2.5–4.0 μ. The conidial fruiting bodies consist of hard, horny, rostrate stromata, usually containing a single cavity, and the apothecia are smaller, mostly about 1.0 mm. in diameter and mostly occurring singly. In *D. Prunastri* (FIG. 43b), the conidia measure 20–30 × 4–7 μ, about the same length as those of *D. Padi* but thicker and not as sharply pointed at the ends. The conidial fruiting bodies are usually cespitose, long-rostrate, very hard and horny in consistency, and contain a single cavity. The apothecia are also usually in clusters, more brownish in color than those of the other two species, and usually less than 1 mm. in diameter. The characters of the asci and ascospores are very similar in all three species. As noted above in the discussion of cultural characters, the cultures of *D. Prunastri* are very different from the other two.

Unfortunately the types of these species have not been available and it has been necessary to rely, for the most part, on published descriptions in order to identify them. *D. Cerasi* and *D. Prunastri* were both first described by Persoon (**1797**) under *Peziza* and were both recognized by Fries (**1822**) under *Cenangium*. Both Persoon (**1822**) and Fries (**1822**) cited the specimen in Moug. & Nestl. Stirp. Crypt. vog. *494* in their accounts of this species; therefore, this exsiccatus should be regarded as authentic. A specimen in the Farlow Herbarium under this number and labelled *Peziza Cerasi* Pers. was examined and good material of both perfect and

imperfect stages was present. The identification of *D. Cerasi* may, therefore, be considered as based on this specimen.

Neither Persoon nor Fries cites any specimens of *D. Prunastri*, but both emphasize the character of the conidial fruiting bodies in their descriptions. As Tulasne (**1865**) pointed out, they believed that these represented the young stages of the apothecia and would eventually expand to form the disc. Tulasne realized that these fruiting bodies and the apothecia were different states of the same fungus. His description fits our fungus well. He noted that the asci and ascospores were indistinguishable from those of *D. Cerasi* but that the apothecia were smaller. One discrepancy in his account is noted in that he says the conidia were scarcely more than 3.5 μ in diameter whereas I find them to be mostly 4–7 μ. He found the conidia of *D. Padi* to be 3.5 μ thick also and this measurement agrees with mine. Possibly he observed immature conidia of *D. Prunastri*.

D. Padi was originally described by Albertini and Schweinitz (**1805**) as a variety of *D. Cerasi*. They noted that it was often solitary and described the conidial fruiting bodies, which they believed to be young apothecia. The fungus was similarly treated by Fries (**1822**) but later (**1849**) raised to specific rank. Tulasne (**1865**) could not find any difference between it and *D. Cerasi* in the apothecial stage, but noted the difference in the form of the pycnidia and in the size of the conidia. Karsten (**1871**) recorded the same observations. Rehm (**1889**) had evidently not seen good material and was very doubtful of this species and later (**1912**) made the statement that it was not notably different from *D. Prunastri*. Nannfeldt (**1932**) recognized all three species in the traditional sense but Seaver and Velasquez (**1933**) considered both *D. Prunastri* and *D. Padi* to be synonyms of *D. Cerasi*.

D. Padi seems to be the least well known of the three species. I have not collected it and have not succeeded in obtaining ascospore cultures. Cultures were obtained from the conidia in one specimen sent by Dr. W. L. White. These cultures resembled cultures of *D. Cerasi* in gross appearance but have produced a conidial stage with the small conidia of *D. Padi*. Because of the difference in the conidia, *D. Padi* should be regarded as a distinct species.

Other species that have been reported on *Prunus* are *Cenangium*

hypodermium (DC.) Sacc., *Dermea vernicosa* (Fckl.) Rehm, *D. olivacea* Otth, *D. Houghtonii* Phill., *D. pulcherrima* Fckl., and *Dermatella hortorum* Kirschst.

Cenangium hypodermium was originally described by De Candolle (**1815**) as *Peziza hypodermium* and was transferred to *Cenangium* by Saccardo (**1889**). Saccardo had apparently not seen any specimens and questioned whether it was really distinct from *D. Cerasi*. However, De Candolle apparently knew both *D. Cerasi* and *D. Prunastri* and considered his *Peziza hypodermium* to be something different. His description of *D. Cerasi* agrees very well with the modern concept of this species, but his description of *P. hypodermium* does not. It is probably a different fungus but its identity is not clear. The description is suggestive of a *Tympanis* and a species of *Tympanis* which is at present without a valid name occurs on *Prunus*. It was described by Rehm (**1889**) as *Tympanis Prunastri* (Fckl.) since he found it in the specimen of Fuckel Fung. Rhen. *1126* labelled *Cenangium Prunastri*. However, this combination had already been used by Wallroth (**1833**) for *Dermea Prunastri* and so was not available for the *Tympanis*. Furthermore, it is evident that Fung. Rhen. *1126* must have been a mixture of two fungi for Fuckel's description is clearly of the *Dermea* and Rehm unquestionably saw a *Tympanis*. Nevertheless, according to Article 56 of the International Rules, *T. Prunastri* Rehm is a synonym of *Dermea Prunastri*.

D. vernicosa (Fckl.) Rehm is a very doubtful species. Fuckel (**1870**) based his original description on the specimen in Fung. Rhen. *2072* which was said to consist of immature apothecia and a conidial stage which, from the description, might be either a microconidial form or the imperfect stage of a *Tympanis*. Fuckel stated that the fungus was close to *Cenangium Cerasi β Padi* but appeared to think it different because of the conidial stage. I have examined the specimen of Fung. Rhen. *2072* in the Farlow Herbarium. There were a few immature apothecia which would not be referred to *Dermea*, and some small black pycnidia with hyaline, one celled, cylindric to ellipsoid conidia 4–6 × 2–3 μ. It is not the microconidial stage of a *Dermea*, but might possibly be poor material of the conidial stage of a *Tympanis*.

Rehm (**1889**) published a description of *D. vernicosa* based on a

specimen which he later (**1912**) stated was actually *D. Prunastri*. The description by Saccardo (**1889**) is evidently based on Rehm's description. Thus apparently no one has ever seen mature apothecia of this species.

D. olivacea Otth, described in 1868, is known to me only through the description in Saccardo (**1899**). The description is suggestive of a *Dermea* but without specimens it is impossible to say whether it is a distinct species or a synonym of one of the three species recognized here.

Dermatella hortorum Kirschst. was originally described as *Dermea olivacea* by Kirschstein in 1906 but later (**1936**) was given a new specific name since he recognized the priority of Otth's name, and was transferred to *Dermatella* because he observed four-septate ascospores. No specimens of this fungus have been seen but, from the description, the asci and ascospores are broader than any of the *Dermea* species I have recognized on *Prunus*. It should be compared with *Pezicula plantarium* Wollenweber (**1939**).

Dermea pulcherrima was described by Fuckel (**1873**) and does not appear to have been recognized since. It seems probable that it was based on unusually large apothecia of *D. Cerasi*.

D. Houghtonii Phill. is a *Pezicula* and is distinct from *P. plantarium* Wollenw.

The description of *Scleroderris Padi* Rostr. (Saccardo, **1906**) suggests a *Dermea* but no material has been available for comparison.

2. DERMEA MOLLIUSCULA (Schw.) Cash, Mycologia **29**: 304. 1937. (FIGS. 21, 39, 47.)

Cenangium molliusculum Schw. Syn. Fung. Amer. Bor. p. 239. 1832.

St. conid.

Gelatinosporium fulvum Peck, Ann. Rep. N. Y. St. Mus. **38**: 97. 1885.

Apothecia strongly erumpent, scattered, separate or in clusters of about 2–6, circular, sinuate, or distorted by crowding and sometimes more or less laterally fused, sessile to substipitate, 1–3 mm. in diameter, 1–2 mm. in height, "ochraceous tawny" or "tawny" (R) to almost black, usually slightly furfuraceous to glabrous,

hard, leathery to horny in consistency, becoming more fleshy-leathery when moist; hymenium at first concave, becoming strongly convex, dark olivaceous-brown to black, greenish when moist, sometimes cracked, at first with a thick, raised, yellowish-brown margin which later disappears; tissue of the basal stroma pseudoparenchymatous, composed of hyaline to brownish, irregular cells 6–12 μ in diameter becoming more elongated above, the central part of the stalk compact, sometimes looser above, composed of closely interwoven, thick-walled hyphae about 5 μ in diameter, curving toward the outside, forming a darker, pseudoparenchymatous excipulum of thick-walled cells about 6–10 μ in diameter; subhymenium a narrow zone of closely interwoven hyphae about 3–4 μ in diameter; asci cylindric-clavate, tapering toward the base, eight spored, (85)100–120(150) × 12–15 μ; ascospores narrow-ellipsoid to subfusiform, hyaline, becoming yellowish, straight or slightly curved, one to four celled, irregularly biseriate to uniseriate, (13)15–20 (22) × 4–7 μ; paraphyses hyaline, filiform, septate, simple or branched, 1.5–2.0 μ in diameter, the tips slightly swollen, embedded in a yellowish matrix and forming a dark epithecium.

Conidial stromata erumpent, gregarious, transversely elongated or almost circular, 1–4 mm. in diameter, 0.5–1.0 mm. in height, slightly furfuraceous, "ochraceous tawny" to blackish, waxy-fleshy in consistency, usually containing several more or less lobed, flask-shaped cavities which tear open irregularly and sometimes very widely; tissue at the base and around the outside of the stroma similar to that of the apothecia, around the cavities composed of ascending, more or less parallel hyphae; conidiophores hyaline, cylindric, septate, simple or branched, 15–30 × 1.5–2.0 μ, conidia hyaline or pale yellowish, subfiliform, ends pointed, sickle-shaped or sigmoid to almost straight, one to four celled, 50–75 × 2.5–3.5 μ, microconidia hyaline, bacilliform, straight or slightly curved, one celled, 7–12 × 1.0–1.5 μ.

HOST: *Betula* spp., commonly *B. lutea* Michx.

SPECIMENS EXAMINED: Type: Durand Herbarium *3933*. Ex Herb. Schweinitz.

CANADA: **Nova Scotia:** N. Halton, DAOM *4694*, JWG *552;*—Colchester Co., JWG *514 ex* LEW *1287a.*—**Quebec:** Duchesnay, DAOM *5317*, JWG *599;* F *ex* USDA *71031;*—Old Chelsea, DAOM *2595*, JWG *440*, F;—Burnet, DAOM *3918*, F.—**Ontario:** Timagami Forest Reserve, T *3525*, JWG *46;* JWG *186;* JWG *193;*—Toronto, T *6773*, JWG *278;*—Petawawa For. Exp. Stn., DAOM *7339*.

UNITED STATES: **New Hampshire:** Randolph, T *ex* Herb. NYBG as *D. Betulae.*—**New York:** Holl Pond, JWG *532.*—**Pennsylvania:** Lycoming Co., JWG *656*.

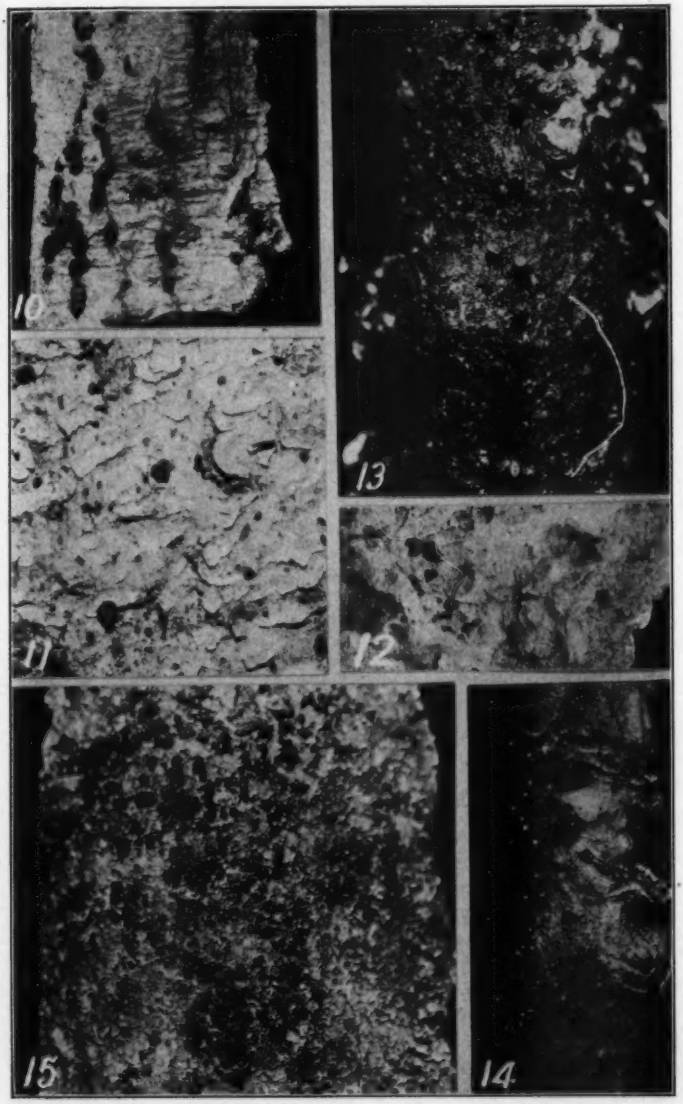
This species was first described by Schweinitz (**1832**) but does not seem to have been very frequently collected and is not well known. Seaver and Velasquez (**1933**) described and illustrated it under the name *Dermea Betulae* Rehm, but, as pointed out by Groves (**1940**), this was a misdetermination since *D. Betulae* Rehm is a *Pezicula*. Cash (**1937**) transferred it to *Dermea*.

The large, strongly erumpent, cespitose apothecia are somewhat similar to those of *D. Cerasi*, but are usually more or less grown together laterally and the outlines of the apothecia are indistinct. The asci are mostly broader than those of *D. Cerasi*. The conidial fruiting bodies are also very similar to those of *D. Cerasi*, consisting of a fleshy stroma containing several flask-shaped cavities, but differ in the ochraceous color. The conidia are similar in shape but longer and slightly narrower.

Dermea fusispora, also described as occurring on *Betula* by Ellis and Everhart (**1893**), is quite a different fungus and does not belong in *Dermea*. A part of the type in the Durand Herbarium *7370* has been seen. The apothecia have somewhat the gross appearance of a *Pezicula* but the hyaline, subfiliform, curved ascospores 18–30 × 2–4 μ exclude it from this genus also. I have collected this fungus twice in the Timagami Forest Reserve and again at Duchesnay, Que., at the Mycological Society Foray held there in 1938. Cultures were obtained from the ascospores but the fungus has never produced any conidial stage in culture and none has been found in nature.

Rehm (**1912**) stated that *D. fusispora* was a synonym of *D. rosella* Rehm which was originally described as occurring on *Quercus*. He cited the specimen in Jaap Fung. Sel. *257a, b*, which is on *Betula* and correctly identified as *D. fusispora*. The type of *D. rosella* has not been seen, but the description fits and if Rehm has correctly identified the Jaap specimen with *D. rosella* there is no question that *D. fusispora* should be considered a synonym.

A still earlier name for the same fungus is *Niptera citrinella* originally described by Rehm (**1881**) as occurring on *Alnus* and transferred to *Pezicula* by Rehm (**1912**). In the original description Rehm cited the specimen in Rehm Ascom. *262*, which should evidently be regarded as the type. Through the kindness of Mr. E. W. Mason slides of this specimen were examined and



FIGS. 10–14. Species of *Dermea*.

later another specimen of the same exsiccatus was seen at the Farlow Herbarium. These agreed with *D. fusispora* and, therefore, *D. fusispora* Ell. & Ev. and *D. rosella* Rehm should be considered as synonyms of *Niptera citrinella* Rehm. The generic position of the fungus is uncertain but it does not belong in either *Dermea* or *Pezicula*.

3. DERMEA BALSAMEA (Peck) Seaver, Mycologia **24**: 42. 1932. (FIGS. 8, 9, 30, 54.)

Cenangium balsameum Peck, N. Y. St. Mus. Ann. Rep. **38**: 101. 1885.

Cenangium balsameum Peck var. *abietinum* Peck, N. Y. St. Mus. Ann. Rep. **43**: 40. 1890.

St. conid.

Gelatinosporium abietinum Peck, N. Y. St. Mus. Ann. Rep. **25**: 84. 1873.

Apothecia erumpent, gregarious, mostly separate, sometimes cespitose with 2–4 in a cluster, sessile, slightly narrowed below, circular or undulate, 1–2.5 mm. in diameter, 0.4–0.8 mm. in height, at first yellowish to brownish, furfuraceous, finally black and glabrous, hard, leathery to horny in consistency, becoming more fleshy-leathery when moist; hymenium at first concave, then plane or slightly convex, often umbilicate, roughened and sometimes cracked, light brown to olivaceous brown or black, more greenish when moist, margin at first raised, yellowish, furfuraceous, later black and glabrous, finally disappearing; tissue of the basal stroma compact, pseudoparenchymatous, composed of almost isodiametric to somewhat elongated cells about 8–12 μ in diameter, hyaline to slightly yellowish and grown together, toward the outside arranged in obliquely parallel rows and smaller, about 5–8 μ in diameter, in the upper central part more elongated and more loosely interwoven; subhymenium a narrow zone composed of slender, hyaline, closely interwoven hyphae; asci cylindric-clavate, tapering into a more or less elongated stalk, eight spored, (90)100–130(150) × (12)14–16 μ; ascospores ellipsoid-fusiform, hyaline or slightly yellowish, one to four celled, straight or slightly curved, irregularly biseriate to sub-uniseriate, (18)20–30(35) × (5)6–8(10) μ; paraphyses hyaline, filiform, septate, usually much branched, 1.5–2.0 μ in diameter, the tips glued together forming a yellowish epithecium, and only very slightly or not at all swollen.

Conidial fruiting bodies erumpent to subimmersed, gregarious to scattered, rounded to cylindric or subconic, 0.5–1.0 mm. in diam-

eter, 0.2–0.5 mm. in height, yellowish or olivaceous to black, furfuraceous to glabrous, tearing open irregularly and widely at the top, brittle, waxy in consistency, more fleshy when moist, usually containing a single, simple or more or less lobed cavity, occasionally with more than one; tissue of the basal stroma compact, composed of closely interwoven hyphae, the cells variable in size and with the walls more or less grown together, the tissue surrounding the cavity composed of an outer zone of more or less parallel to slightly interwoven, ascending hyphae, a middle zone of closely interwoven hyphae with darker walls, and an inner zone of hyaline, interwoven hyphae from which the conidiophores arise; conidiophores hyaline, septate, sometimes branched, tapering to a slender tip, 15–25 × 2.0–2.5 μ; conidia elongate-filiform, pointed at the ends, hyaline to pale greenish yellow, one to four celled, usually curved, sickle-shaped to sigmoid, sometimes almost straight, (50)60–75(90) × 4–5 μ; microconidia hyaline, filiform, straight or curved, one celled, 11–22 × 1.0–1.5 μ.

HOST: *Abies balsamea* (L.) Mill., *Tsuga canadensis* (L.) Carr.

EXSICCATI: Rel. Farl. *102.*

SPECIMENS EXAMINED: Type. Durand Herbarium *6111.*

CANADA: **Nova Scotia:** on *Abies balsamea,* Colchester Co., JWG *513 ex* LEW *2072;* T, LEW *1082;*—Glenmont, DAOM *3977;*—Truro, T, LEW *1791;*—on *Tsuga canadensis,* JWG *799 ex* LEW *1792.*—**Quebec:** on *Abies balsamea,* Burnet, JWG *121,* F; DAOM *3320;*—Duchesnay, DAOM *5309,* JWG *618;*—Ile Jésus, DAOM *7342;*—on *Tsuga canadensis,* Burnet, DAOM *2680,* JWG *442;*—Kingsmere, JWG *734.*—**Ontario:** on *Abies balsamea,* Timagami Forest Reserve, T *3523,* JWG *45;* T *3527,* JWG *18;* T *3528,* JWG *43;* T *4305,* F; T *4306,* JWG *36,* DAOM *4282;* T *4386,* JWG *10;* T *4388,* JWG *15;* T *4389,* JWG *16;* T *4390,* JWG *24;* T *6591,* JWG *163;* T *7923,* F; JWG *20;* JWG *32;* JWG *51;* JWG *633 ex* Darker *2199;* DAOM *2532;*—Muldrew L., F, White *3123;*—Petawawa For. Exp. Stn., DAOM *4718;* DAOM *7319;*—Cash L., DAOM *5954;*—on *Tsuga canadensis,* Toronto, T *4372,* JWG *63;* T *4535,* JWG *76;* T *4550,* F; T *4834,* JWG *133;* T *6561,* JWG *281;* T *6566,* F; JWG *87.*

UNITED STATES: **New Hampshire:** on *Abies balsamea,* Shelburne, F Sept. 1891;—on *Tsuga canadensis,* Chocorua, F Sept. 25, 1909; F Aug. 20, 1917.—**Maine:** on *Abies balsamea,* Popham Beach, F July 31, 1933.—**Virginia:** on *Tsuga canadensis,* Shenandoah Nat. Park, F, White *3599.*—**Pennsylvania:** on *Abies balsamea,* Siglerville, JWG *444 ex* LOO *19019;* on *Tsuga canadensis,* Huntingdon Co., DAOM *1954.*

Dermea balsamea was first described by Peck (**1885**) as *Cenangium balsameum,* occurring on *Abies.* Later Peck (**1890**) described a collection on *Tsuga* as a variety, *C. balsameum* var. *abietinum.* Here he noted its association with the conidial fungus

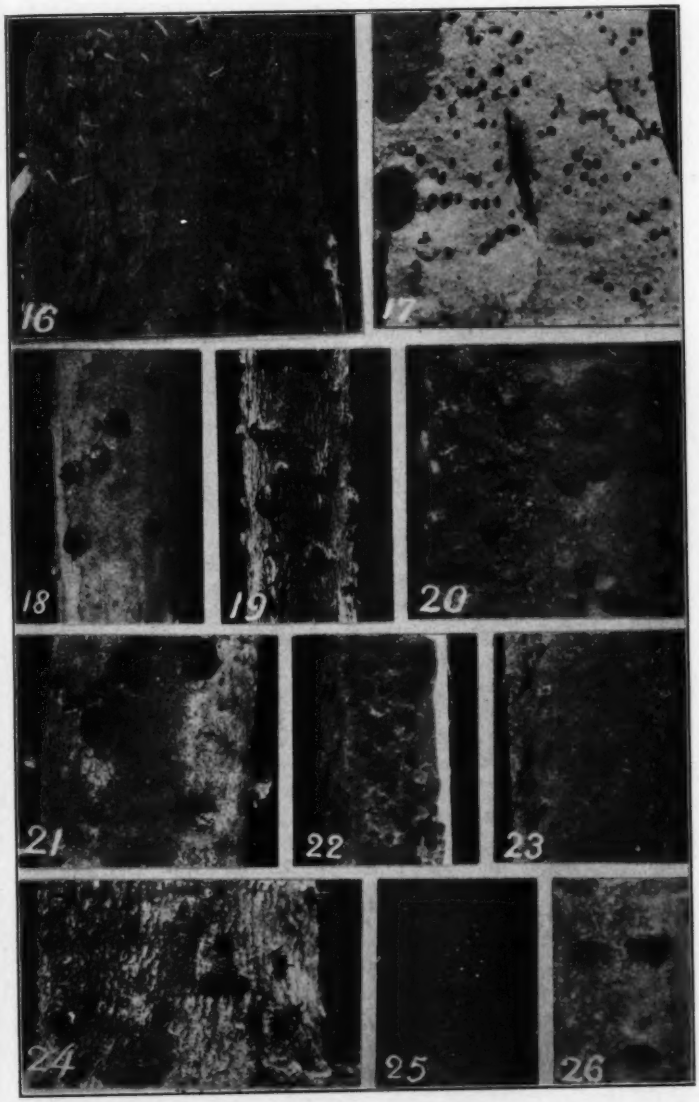
which he had described much earlier (**1873**) as *Gelatinosporium abietinum*, and on which he had based the genus *Gelatinosporium*. Several collections on both *Abies* and *Tsuga* have been cultured from both ascospores and conidia, and no difference has been found which would appear to justify the maintenance of the form on *Tsuga* as a separate variety. Dodge (**1932**) found this species associated with a die-back of *Tsuga* and established the genetic connection of the perfect and imperfect stages by means of cultural studies. Dodge's fungus was identified by Seaver who transferred it to *Dermea*.

No difference worthy of generic rank appears to exist between *Gelatinosporium abietinum*, the type of the genus *Gelatinosporium*, and *Micropera Drupacearum*, the type of the genus *Micropera*. Since *Micropera* is the older name, the genus *Gelatinosporium* should be regarded as a synonym of *Micropera*.

D. balsamea is one of the larger species of *Dermea*, the apothecia sometimes exceeding 2 mm. in diameter. It can be distinguished from *D. Cerasi* and *D. molliuscula*, the other two large species, by its occurrence on *Abies* and *Tsuga* and the apothecia usually occurring singly or in small clusters of two or three. The asci tend to be somewhat broader and the ascospores slightly larger than either of the other two but the sizes overlap. The conidia are mostly longer than those of *D. Cerasi* and broader than those of *D. molliuscula*. The conidial fruiting bodies usually contain only a single cavity and are smaller and more pycnidium-like than those of either of the other two species.

It is not known whether or not this fungus occurs in Europe, but as pointed out by Dodge (**1932**), *Micropera Abietis* Rostr., from its description, seems to be very close to and perhaps identical with *Gelatinosporium abietinum*. The description of *D. abietinum* Vel. suggests *D. balsamea* but the figure shows an apothecium with a more pronounced stipe and ascospores that are more ovoid in shape than those of *D. balsamea*.

As noted above, *D. balsamea* is the only species of *Dermea* that has produced apothecia in culture. They have been obtained on sterilized twigs of both *Abies* and *Tsuga* in cultures originating from both ascospores and conidia. These apothecia produced asci and ascospores typical of those found in nature and the ascospores,



FIGS. 16–26. Species of *Dermea*.

on germination, gave rise to cultures similar in appearance to those obtained from nature.

4. DERMEA PECKIANA (Rehm) Groves, Mycologia **29**: 67. 1937. (FIGS. 18, 26, 35, 56.)

Cenangium Peckianum Rehm, Ann. Myc. **13**: 3. 1915.

St. conid.

Sphaeronema stellatum Ellis, Bull. Torrey Club **6**: 107. 1876.

Sphaerographium stellatum Sacc. Syll. Fung. **3**: 598. 1884.

Micropera Nemopanthis Peck, Ann. Rep. N. Y. St. Mus. **46**: 109. 1893.

Micropera stellata Jacz. Nouv. Mém. Soc. Imp. Natur. Moscou **15**: 366. 1898.

Apothecia arising from the old conidial stroma, cespitose, crowded, up to 15 in a cluster, about 0.3–0.8 mm. in diameter, and the clusters up to 1 mm. in height, circular or undulate, slightly narrowed below, dark brown to black but the basal stroma pale yellowish, hard, leathery to horny in consistency, becoming more fleshy-leathery when moist; hymenium at first concave, becoming plane or convex, dark brown to black, slightly roughened, with a brownish margin which is at first raised and more or less infolded, later almost disappearing; tissue of the basal stroma compact, pseudoparenchymatous, composed of hyaline, thick-walled cells about 8–20 × 5–10 μ, arranged in more or less vertically parallel rows, curving obliquely toward the outside where the cells are smaller, more isodiametric and with thicker and darker walls; subhymenium composed of slender, closely interwoven hyphae; asci cylindric-clavate, tapering to a slender stalk, eight spored (65)75–90(110) × 9.5–12.5 μ; ascospores ellipsoid-fusiform, hyaline to pale yellowish, straight or slightly curved, one to two (to four?) celled, (10)12–18(23) × (3)4–6 μ; paraphyses hyaline, filiform, septate, simple or branched, 1.5–2.0 μ in diameter, the tips swollen to 3–5 μ and glued together forming a yellowish epithecium.

Conidial stromata erumpent, rounded, verruciform, often somewhat capitate, usually thickly scattered, circular to more or less transversely elongated, 0.5–2.0 mm. in diameter and up to 1 mm. in height, upper surface uneven and wrinkled around the openings of the cavities, pale yellowish below to black on top, often with a dark vinaceous color when fresh, leathery to fleshy in consistency, softer than the apothecia; pycnidial cavities numerous in the upper part of the stroma, sometimes becoming more or less confluent, ovoid to more or less irregular in shape, opening irregularly and sometimes

very widely; conidiophores hyaline, cylindric, septate, sometimes branched, 20–40 × 2.0–2.5 μ, tapering to a slender tip on which the spores are borne; conidia hyaline, elongate-fusiform to subfiliform, sickle-shaped or sigmoid, sometimes almost straight, ends pointed and usually one end more attenuated than the other, one or two celled, (25)40–55(60) × 2.5–4.5 μ, emerging in grayish masses which often show a dark vinaceous color, microconidia hyaline, filiform, straight or curved, one celled, 8–13 × 1.5–2.0 μ.

HOST: *Nemopanthus mucronata* (L.) Trel., *Ilex verticillata* (L.) Gray.

EXSICCATI: Ell. N. Am. Fung. *3042*, Type; *2170*, (*Sphaeronema stellatum*); Fung. Columb. *332*.

SPECIMENS EXAMINED: CANADA: **Nova Scotia:** on *Nemopanthus mucronata*, Oxford, DAOM *3784*, JWG *497*.—**Quebec:** Duchesnay, DAOM *5300*, JWG *613*;—St. Elzéar, DAOM *3781*;—Eardley, DAOM *4682*; DAOM *4685*, F;—Ile Perrot, DAOM *7685*; on *Ilex verticillata*, Burnet, DAOM *3976*; JWG *587*.—**Ontario:** on *Nemopanthus mucronata*, Timagami Forest Reserve, T *4368*; T *4467*; T *4468*; T *4469*; T *4470*; T *4471*; T *6576*; T *6578*, JWG *257*; T *6592*, JWG *232*; T *7930*, F; T *7931*; T *8438*; DAOM *2552*; JWG *166*; JWG *201*; JWG *199*; JWG *248*;—Petawawa For. Exp. Stn., DAOM *7343*, JWG *721*; DAOM *7936*; JWG *772*;—Wilcox L., T *6926*;—Parry Sound, T *6933*;—Brant Co., T *7929*;—on *Ilex verticillata*, Timagami Forest Reserve, T *4511*; T *5071*, JWG *143*; T *7931*, F; T *8439*; T *8444*; JWG *428*;—Parry Sound, T *6953*, JWG *286*, F.

UNITED STATES: **Michigan,** on *Ilex verticillata*, Ypsilanti, T *ex* Univ. Mich. Crypt. Herb.

D. Peckiana was first described by Rehm (**1915**) as *Cenangium Peckianum* based on the specimen in Ellis N. Amer. Fung. *3042*. It was transferred to *Dermea* by Groves (**1937**) and the genetic connection with the conidial stage was then established.

In nature this fungus is frequently found closely associated with *Durandiella Nemopanthis* (Peck) Groves, the fruiting bodies often occurring intermingled on the same twigs. The apothecia of the *Dermea* can be distinguished in gross appearance by their more regular outline and dark brown color. The apothecia of the *Durandiella* are usually very undulate and black, and are also tougher in consistency. The two fungi can be distinguished very easily microscopically by the ascospores which are ellipsoid-fusiform in the *Dermea* and filiform in the *Durandiella*.

The nomenclature of the conidial stage was discussed by Groves (**1937**). It is quite distinct from all other species of *Micropera*

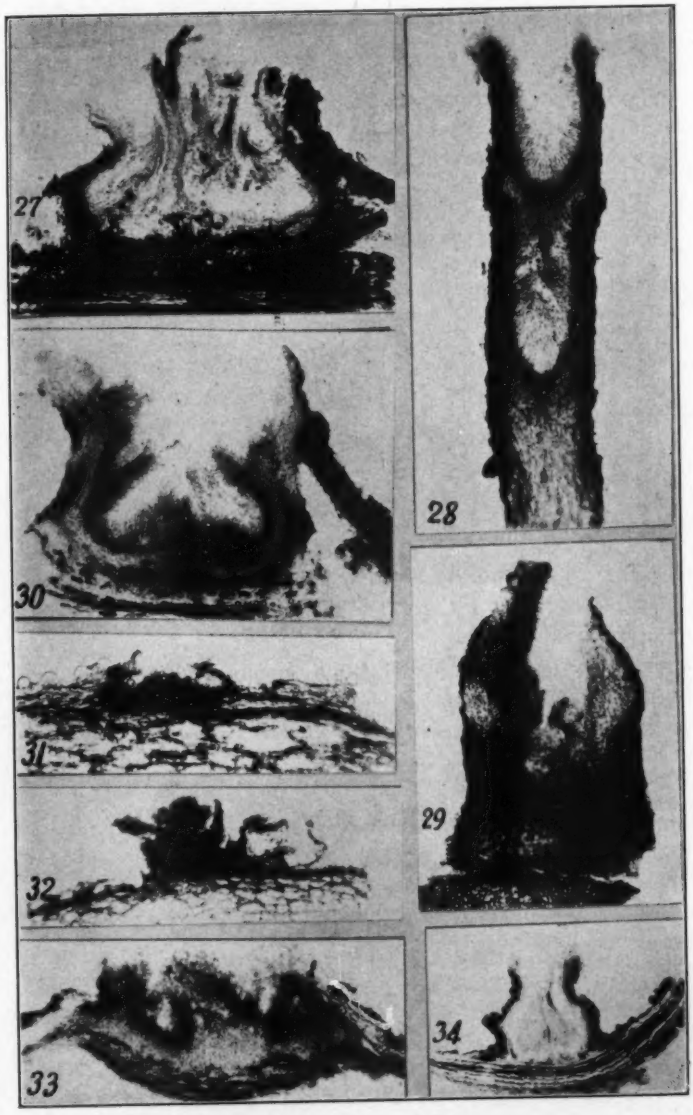
studied by reason of the excessive development of the basal stroma with several cavities developing in the upper part. The apothecia appear to arise from the old conidial stroma and in their habit of growth are distinct from other *Dermea* species. No difference worthy of specific rank could be detected between the forms on *Nemopanthus* and *Ilex*.

Dermea olivacea, described by Ellis (**1876**) as occurring on *Ilex*, is a distinct species which is more closely allied to *Pezicula* than to *Dermea*. Through the kindness of Dr. F. J. Seaver it was possible to examine the type. The apothecia are about the same size as those of *D. Peckiana*, but are less cespitose, a little lighter colored, and softer in consistency. It can readily be distinguished from *D. Peckiana* by the size of the asci, 110–135 × (22)26–33(36) μ, and the ascospores, (20)25–32(38) × (9)11–13(15) μ. I have not collected this fungus or studied it in culture, but from the specimens examined it is a better *Pezicula* than *Dermea*. However, the name is invalid as it is a later homonym of *D. olivacea* Otth.

5. **Dermea Libocedri** n. sp. (FIGS. 7, 31, 57.)

Apotheciis erumpentibus, gregariis, solitariis vel 2–4 congregatis, sessilibus, versus basim leviter attenuatis, orbicularibus vel undulatis, 0.3–0.5 mm. diam., 0.2–0.3 mm. altis, brunneis vel atris, coriaceis vel corneis, in humido carnoso-coriaceis; hymenio concavo vel plano, atro, margine initio elevato, brunneo, dein evanescente; hypothecio pseudoparenchymatico; ascis cylindraceo-clavatis, octosporis, 75–100 × (12)14–17 μ; ascosporis ellipsoideo-fusiformibus, hyalinis, rectis vel leviter curvulis, continuis vel triseptatis, 15–20 × 6–8 μ; paraphysibus hyalinis, filiformibus, simplicibus vel ramosis, 1.5–2.0 μ diam. apice ad 3–4 μ incrassatis, epithecium formantibus.

Apothecia erumpent, gregarious, separate or in small clusters of two to four, sessile, slightly narrowed below, circular to slightly undulate, 0.3–0.5 mm. in diam., 0.2–0.3 mm. in height, dark brownish black to black, leathery to horny in consistency, becoming more fleshy-leathery when moist; hymenium concave to plane, black, rough, with a thick, brownish, raised margin which later disappears; tissue of the basal stroma compact, pseudoparenchymatous, composed of hyaline, thick-walled cells about 4–7 μ in diameter, almost isodiametric to slightly elongated, arranged in more or less vertically parallel rows, curving obliquely toward the outside where the cells are slightly brownish and thicker walled; subhymenium indistinct; asci cylindric-clavate, short-stalked, eight spored, 75–100 × (12)14–17 μ; ascospores ellipsoid-fusiform, hyaline, one to four



FIGS. 27–34. Species of *Dermea*.

celled, straight or slightly curved, biseriate above to uniseriate below, 15–20 × 6–8 μ, paraphyses hyaline, filiform, simple or branched, 1.5–2.0 μ in diameter, the tips swollen to 3–4 μ and forming an epithecium.

Conidial fruiting bodies erumpent, separate, black, glabrous, minute, 0.2–0.3 mm. in diameter and about the same in height, rounded to subcylindric, opening at the tip, similar in consistency to the apothecia, containing a single oval or slightly lobed cavity lined with conidiophores, the walls surrounding the cavity similar in structure to the tissue of the apothecia, basal stroma about 15–30 μ in thickness, pseudoparenchymatous, similar to the apothecia; conidiophores hyaline, cylindric, pointed at the tip, simple or branched near the base, continuous, occasionally septate, 20–30 × 2.5–3.5 μ; conidia elongate-filiform, hyaline, sickle-shaped or sigmoid, pointed at the ends, one to four celled, 42–65 × 4–6 μ; microconidia hyaline, filiform, one celled, straight or curved, ends not pointed, 10–18 × 1.0–1.5 μ.

HOST: *Libocedrus decurrens* Torr.

SPECIMENS EXAMINED: JWG *691*, Darlingtonia, Del Norte Co., Calif. Coll. H. E. Parks. Nov. 21, 1939. Type.

This species is known only from a single, fragmentary specimen. In November, 1939, I received from Mr. H. E. Parks a specimen of *Libocedrus decurrens* bearing apothecia of a *Pezicula*. On examining this material carefully with a dissecting microscope, a few apothecia of a *Dermea* species and conidial fruiting bodies of an associated *Micropera* species were discovered. All the material of the *Dermea* that could be found was on a small piece of bark about 5.5 cm. long and 1.0 cm. in width. An attempt was made to obtain cultures and successful isolations were made from the conidia but the apothecia failed to discharge spores. The cultures from the conidia readily produced conidial fruiting bodies on malt agar.

It is realized that it is rather unsatisfactory to describe a species based on such scanty material. However, Mr. Parks was unable to obtain more and since the characters seem quite distinct it appears desirable to put it on record in the hope that it will be collected again.

Because of the long, sharply pointed conidia, this species might be considered closely related to the group of species described above. The small size of the apothecia, not exceeding 0.5 mm. in the ma-

terial examined, will readily distinguish it from most of the other species with similar conidia, i.e. *D. Cerasi, D. balsamea,* and *D. molliuscula,* in all of which the apothecia usually exceed 1 mm. in diameter. The apothecia are closer in size to those of *D. Peckiana* which also has long, pointed conidia, but the apothecia of *D. Libocedri* appear to be mostly single and not clustered on a thick, basal stroma as in *D. Peckiana.* The host is also distinctive.

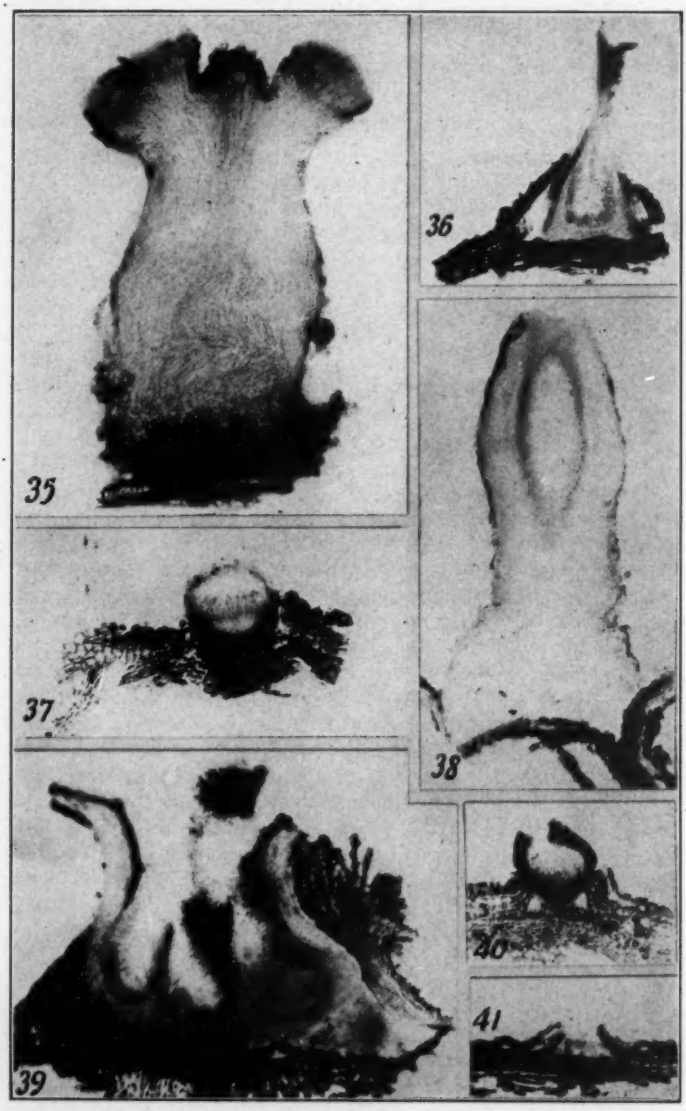
6. DERMEA VIBURNI Groves, Mycologia **32**: 745. 1940. (FIGS. 24, 38, 49.)

St. conid.

Sphaeronema hystricinum Ellis, Bull. Torrey Club **6**: 106. 1876.
Sphaerographium hystricinum Sacc. Syll. Fung. **3**: 597. 1884.
Chondropodium hystricinum Höhnel, Fragm. Myk. 958. 1916.
Sphaerographium hystricinum var. *Viburni* Dearn. & House, Bull. N. Y. State Mus. **197**: 35. 1917.

Apothecia erumpent, separate or in small clusters of 2–6, sessile, slightly narrowed below, circular or slightly undulate, 0.3–0.6(1.0) mm. in diameter and 0.2–0.5 mm. in height, dark brown to black, hard, leathery to horny in consistency, becoming more fleshy-leathery when moist; hymenium black, at first concave, becoming plane to convex, margin at first raised, later almost disappearing; hypothecium composed of closely interwoven, hyaline to pale brownish, thick-walled hyphae about 5–8 μ in diameter, in the upper part more or less vertically parallel, curving obliquely toward the outside where the walls are darker colored; subhymenium a narrow brownish zone; asci cylindric-clavate, short-stalked, eight spored, (50)60–75 × 8–12.5 μ; ascospores ellipsoid-fusiform, hyaline, becoming slightly yellowish, straight or slightly curved, one or two celled, (10)14–18(20) × 3.5–5.5 μ; paraphyses hyaline, filiform, septate, much branched, 1.5–2.0 μ in diameter, the tips slightly swollen up to 3 μ and glued together forming a yellowish epithecium.

Conidial fruiting bodies erumpent, thickly scattered or more or less in rows, single or with two or three arising from the same basal stroma, cylindric-subulate, dark brown to black, often with a reddish tinge—especially when moist—base about 0.3–0.5 mm. in diameter and the beaks about 1 mm. long, hard, leathery to horny, becoming more fleshy when moist; tissue of the basal stroma composed of closely interwoven, ascending, hyaline, thick-walled hyphae about 5–8 μ in diameter, becoming darker colored and thicker walled at the outside, tissue of the beak similar in structure, the



FIGS. 35–41. Species of *Dermea*.

basal stroma containing a single ovoid to elongated cavity about 150–250 μ in diameter; conidiophores cylindric, septate, occasionally branched, tapering to a slender point, 15–30 × 2.0–2.5 μ, lining the cavity and the beak; conidia elongate-fusiform to subfiliform, hyaline, sickle-shaped or sigmoid to almost straight, usually with one end more attenuated than the other, one to four celled, (25)30–45 × 2.5–4.0 μ. No microconidia have been observed in nature.

HOST: *Viburnum* spp., *V. Lentago* L., *V. cassinoides* L., *V. nudum* L.

EXSICCATI: Ell. N. Am. Fung. *337* (*Sphaerographium hystricinum*); Rel. Farl. *198a, 198b* (*S. hystricinum*).

SPECIMENS EXAMINED: CANADA: **Quebec:** MacDonald College, DAOM *7649;*—Duchesnay, DAOM *5308,* JWG *600;*—**Ontario:** Hatchley, T *7937* Type, JWG *433,* F;—Timagami Forest Reserve, T *4460;* T *4461;* T *6976,* JWG *230;* T *8432;* JWG *268;*—Wilcox Lake, T *4558,* JWG *83;*—Parry Sound, T *7171;* T *7266,* JWG *275;*—Petawawa Forest Exp. Stn., DAOM *7322;* DAOM *7266,* JWG *767.*

UNITED STATES: **Vermont:** Ripton, F;— **Massachusetts:** Canton, F;—**New York:** Seventh Lake, Inlet, T.

This species was described by Groves (**1940**), and the conidial stage discussed. Its genetic connection with the *Dermea* was established. In this species the conidial fruiting bodies are much more conspicuous than the apothecia. The fungus occurs commonly on species of *Viburnum* but usually only the conidial stage is encountered. The apothecia have seldom been collected and when found were usually few and inconspicuous.

It has been placed among the species with long conidia but it differs from the others of this group in having conidia with one end much more attenuated than the other. The apothecia are small, not much larger than those of *D. Libocedri,* but the asci and ascospores are smaller than in this species and the conidial stage is quite different.

7. DERMEA PADI (Alb. & Schw.) Fr. Summ. Veg. Scand. p. 362. 1849. (FIGS. 3, 4, 29, 44.)

Peziza Cerasi β Padi Alb. & Schw. Consp. Fung. Nisk. p. 345. 1805.

Cenangium Cerasi β Padi Fries, Syst. Myc. **2**: 180. 1822.

Tympanis Padi Quél. Enchir. Fung. p. 330. 1886.

St. conid.

Sphaeria fallax Wahl. Fl. Lapponica p. 522. 1812.
Cenangium fallax Fries, Vet. Akad. Handl. p. 361. 1818.
Sphaeria padina Pers. in Moug. Stirp. Crypt. no. 667. 1820.
Micropera padina Sacc. Mich. **2**: 104. 1880.
Sphaeronema brunneo-viride Auersw. in Sacc., Syll. Fung. **3**: 186. 1884.
Cryptosporium brunneo-viride Jacz. Nouv. Mém. Soc. Imp. Natur. Moscou **15**: 95. 1898.

Apothecia erumpent, gregarious, separate or cespitose in groups of 2–6, sessile, narrowed below, circular or undulate, 0.5–1.0(1.5) mm. in diameter and about 0.3–1.0 mm. in height, dark reddish-brown to black, hard, leathery to horny in consistency, becoming more fleshy-leathery when moist; hymenium at first concave, then plane to convex, roughened, black or dark brown, margin at first thick, raised, brownish, furfuraceous, then glabrous and disappearing; tissue of the basal stroma compact, pseudoparenchymatous, composed of hyaline cells 5–10 μ in diameter, isodiametric to slightly elongated, the walls thickened and gelatinized, arranged in more or less vertically parallel rows, curving toward the outside where the walls are thicker and darker; subhymenium a narrow zone of slender interwoven hyphae; asci cylindric-clavate, tapering to a short stalk, eight spored, (65)85–100(110) × 10–13(15) μ; ascospores ellipsoid-fusiform, hyaline becoming yellowish, straight or slightly curved, one to two or occasionally four celled, irregularly biseriate, (12)15–20 × (4)5–7 μ; paraphyses hyaline, filiform, septate, simple or branched, 1.5–2.0 μ in diameter, the tips swollen up to 3 μ and glued together forming a yellowish epithecium.

Conidial fruiting bodies erumpent, scattered, mostly separate, occasionally two or three in a cluster, cylindric to conic, 0.5–1.3 mm. in height, 0.2–0.5 mm. in diameter, opening circularly at the tip, dark reddish-brown to black, glabrous, hard, leathery to horny in consistency, more fleshy-leathery when moist, containing an elongate-ovoid cavity; tissue of the basal stroma compact, composed of almost isodiametric cells 5–10 μ in diameter, with thickened, gelatinized walls, in the central part the cells becoming more elongated and the tissue composed of ascending, parallel hyphae, tissue surrounding the cavity composed of three zones, an outer pseudoparenchymatous zone composed of isodiametric, dark walled cells, a middle zone of parallel hyphae about 3–5 μ in diameter, and an inner zone of small isodiametric cells about 3 μ in diameter from which the conidiophores arise; conidiophores cylindric, tapering to a slender point, sometimes swollen below the point of attachment

of the spore, septate, simple or branched, 25–50 × 2–3 μ; conidia elongate-fusiform to subfiliform, pointed at the ends, one end usually slightly more pointed than the other, sickle-shaped to almost straight, one or two celled, hyaline, (18)20–28(35) × 2.5–4.0 μ; microconidia hyaline, bacilliform, straight or slightly curved, one celled, 4–6 × 1.5 μ.

HOST: *Prunus* spp. *P. domestica* L., *P. Padus* L., *P. spinosa* L., *P. virginiana* L.

EXSICCATI: All. & Schn. Fung. Bav. *549* (*D. Prunastri*); Roum. Fung. Gall. Exs. *1459* (*Cenangium Prunastri*), *89* (*Sphaeria padina*); Syd. Myc. Germ. *1379* (*Micropera padina*); Lib. Pl. Crypt. Ard. *131.*

SPECIMENS EXAMINED: UNITED STATES: **New York:** Labrador Lake, JWG *460,* F, White *2380;*—McLean, JWG *471,* F, White *2397.*

EUROPE: **Austria:** *ex* Herb. Barbey-Boissier *1112,* T, F.

This species was discussed above under *D. Cerasi,* which it closely resembles. The most striking difference is in the size of the conidia. The apothecia are generally a little smaller, less cespitose, and a little more reddish-brown in color than those of *D. Cerasi* but it is very difficult to separate them in the apothecial stage alone.

I have not collected this species and only one specimen from W. L. White (JWG *460*) has been studied in the fresh condition. In it the apothecia failed to discharge spores, but cultures were obtained from the conidia. The cultures resembled those of *D. Cerasi,* but the difference in size of the conidia remained constant in culture.

8. DERMEA BICOLOR (Ellis) Groves, Mycologia **35**: 460. 1943. (FIGS. 19, 20, 33, 45.)

Tympanis bicolor Ellis, Amer. Nat. **17**: 193. 1883.

Cenangium bicolor Sacc. Syll. Fung. **8**: 557. 1889.

Cenangium dichroum Sacc. Syll. Fung. **8**: 1143. 1889.

Patinella Brenckleana Sacc. Mycologia **12**: 203. 1920.

Dermea Brenckleana Seaver, Mycologia **25**: 142. 1933.

Apothecia erumpent, gregarious, mostly separate, sometimes in more or less elongated clusters, circular or undulate, sessile, narrowed below, 0.5–1.5 mm. in diameter, 0.5–1.0 mm. in height, at first slightly furfuraceous, yellowish or greenish when moist, finally dark brown to black and glabrous, hard, leathery to horny in consistency, becoming more fleshy-leathery when moist; hymenium concave to plane or slightly convex, greenish when young and

moist, drying dark brown to black, slightly roughened, at first with a thick, raised, furfuraceous, yellowish margin which may disappear later; tissue of the basal stroma pseudoparenchymatous, composed of hyaline to yellowish, irregular cells about 5–12 μ in diameter, arranged in more or less vertically to obliquely parallel rows above, thicker walled and darker toward the outside forming a firm excipulum, in the central part becoming more elongated and interwoven; subhymenium a zone of interwoven, ascending, hyaline hyphae about 2–4 μ in diameter; asci cylindric-clavate, tapering below to a short stalk, eight spored, (56)60–70(87) $\times$ 8–10 μ; ascospores ellipsoid-fusiform, straight or slightly curved, one or two celled, hyaline becoming yellowish-brown, irregularly biseriate to uniseriate, (11)12–15(16) $\times$ 3–4(4.5) μ; paraphyses hyaline, filiform, septate, simple or branched, 1.5–2.0 μ in diameter, the tips scarcely swollen but more or less glued together forming an epithecium.

Conidial fruiting bodies splitting the bark, more or less immersed to slightly erumpent, gregarious, variable in shape, circular to elongated or angular, 0.2–0.8 mm. in diameter, 0.2–0.4 mm. in height, yellowish, furfuraceous, more or less wrinkled, soft, waxy in consistency, becoming more fleshy when moist, containing one to several more or less lobed cavities which open irregularly and sometimes widely, exposing the greenish to yellowish spore masses; tissue compact, pseudoparenchymatous, composed of hyaline, almost isodiametric to irregular cells about 4–7 μ in diameter, sometimes more elongated and interwoven above; conidiophores lining the cavity, hyaline, cylindric, septate, not observed branching, tapering to a pointed tip, 15–30 $\times$ 1.5–2.5 μ; conidia hyaline, fusiform, sickle-shaped or almost straight, pointed at the ends, one celled or occasionally two celled, (12)15–20(25) $\times$ 2.5–4.0 μ; no microconidia observed in nature.

HOST: *Amelanchier* spp.

SPECIMENS EXAMINED: CANADA: **Ontario:** Timagami Forest Reserve, T *17324*, JWG *412;*—Petawawa Forest Exp. Stn., DAOM *7338*, JWG *715;* DAOM *7512*, JWG *720;* DAOM *7534*, JWG *725;* DAOM *7935*, JWG *768.* UNITED STATES: **Iowa:** Decorah, Durand Herbarium *7440*, Type of *Tympanis bicolor;*—Whitestone Gully, F. Brenckle *1196*, Type of *Patinella Brenckleana.*

This species was recently discussed by Groves (**1943**). The genetic connection of the conidial stage was established and the evidence for the identity of *Dermea Brenckleana* and *Tympanis bicolor* was presented there. Macroscopically both perfect and im-

perfect stages are similar to those of *D. Cerasi* though somewhat smaller, but microscopically they are both much closer to *D. Ariae*.

9. DERMEA ARIAE (Pers. *ex* Fr.) Tul. *ex* Karst. Myc. Fenn. **1**: 224. 1871. (FIGS. 22, 23, 34, 53.)

Peziza Ariae Pers. Myc. Eur. **1**: 325. 1822.

Tympanis Ariae Fries, Syst. Myc. **2**: 175. 1822.

Cenangium Ariae Tul. Ann. Sc. Nat. sér III, **20**: 136. 1853.

Tympanis inconstans Fries, Summa Veg. Scand. p. 400. 1849.

Cenangium inconstans Fuckel, Symb. Myc. p. 268. 1870.

Cenangium subnitidum Cooke & Phill. Grevillea **3**: 186. 1875.

Phaeangella subnitida Massee, Brit. Fung. Fl. **4**: 137. 1895.

St. conid.

Sphaeria Cotoneastri Fries, in Kunze Myk. Heft. **42**: 46. 1823.

Micropera Cotoneastri Saccardo, Syll. Fung. **3**: 605. 1884.

Sphaeria conica Alb. & Schw. Consp. Fung. p. 51. 1805.

Sphaeria Cotoneastri β Sorbi Fries, Syst. Myc. **2**: 494. 1823.

Micropera Sorbi Sacc. Michelia **2**: 104. 1880.

Sphaeronema pallidum Peck, N. Y. St. Mus. Ann. Rep. **25**: 85. 1873.

Phoma pallida Jacz. Nouv. Mém. Soc. Nat. Moscou **15**: 341. 1898.

? *Septoria inaequalis* Sacc. & Roum. Rev. Myc. **6**: 35. 1884.

? *Rhabdospora inaequalis* Sacc. Syll. Fung. **3**: 580. 1884.

Apothecia erumpent, gregarious, separate or in small clusters of two to four, circular to undulate, sessile, narrowed below, 0.4–0.8 (1.0) mm. in diameter, 0.2–0.4 mm. in height, dark reddish-brown to black, slightly furfuraceous to glabrous, hard, leathery to horny in consistency, more fleshy-leathery when moist; hymenium concave to plane, black, with a thick, raised, brownish margin; tissue of the hypothecium compact, pseudoparenchymatous, composed of irregular, thick-walled cells, 3–8 μ in diameter, arranged in more or less vertically parallel rows, curving obliquely toward the outside where the walls are thicker and darker; subhymenium a narrow, indefinite zone of slender, interwoven hyphae; asci cylindric-clavate, narrowed into a short stalk, eight spored, (60)70–90(100) × 8–10 μ; ascospores ellipsoid-fusiform, hyaline to pale yellowish, one to four celled, straight or slightly curved, irregularly biseriate above to uniseriate below, (10)12–18(22) × 3–5 μ; paraphyses hyaline, filiform, septate, simple or branched, 1.5–2.5 μ in diameter,

the tips swollen up to 5 μ and glued together forming a yellowish epithecium.

Conidial fruiting bodies erumpent, gregarious, usually separate, sometimes two or three together, bluntly conical, about 250–350 μ in diameter at the base, 250–500 μ in height, reddish-brown to olivaceous or black, slightly furfuraceous to glabrous, hard, horny in consistency, becoming softer and more fleshy when moist, containing a single, ovoid or slightly chambered cavity; tissue pseudoparenchymatous in the basal stroma, composed of irregular, hyaline cells about 3–6 μ in diameter, becoming prosenchymatous above, composed of ascending, parallel to more or less interwoven hyphae 2–3 μ in diameter, brownish at the outside; conidiophores hyaline, cylindric, simple or branched, continuous or septate, pointed at the tip, 20–40 × 1.5–2.0 μ; conidia hyaline to pale yellowish-green, elongate-fusiform, sickle-shaped or occasionally sigmoid to almost straight, ends pointed, one or two celled, (12)15–20(25) × 2.0–4.0 μ; microconidia not observed in nature.

HOST: *Sorbus americana* Marsh., *S. Aucuparia* L., *Sorbus* spp.

EXSICCATI: Moug. & Nestl. Stirp. Crypt. Vog. *888* (*Peziza Ariae*); Fckl. Fung. Rhen. *1761* (*Tympanis inconstans*); Rehm Ascom. *1057*; Phill. Elv. Brit. *94* (*Cenangium subnitidum*); Kl. Herb. viv. myc. *344* (*Tympanis alnea*); Krieg. Fung. Sax. *1516*; Roum. Fung. Sel. Gall. *537* (*Peziza Ariae*), *1722* (*Micropera Sorbi*); Syd. Myc. Germ. *1992* (*Micropera Cotoneastri*); Fung. Columb. *571* (*Sphaeronema pallidum*).

SPECIMENS EXAMINED: CANADA: **Nova Scotia:** Truro, JWG *641 ex* LEW *402*.—**Quebec:** Duchesnay, DAOM *5301*, JWG *609*; JWG *626 ex* USDA, C. L. Shear *4161*.—**Ontario:** Timagami Forest Reserve, T *4494*; T *4495*, JWG *68*; T *4496*, JWG *69*, F; T *7283*, JWG *180*; T *7918*, JWG *332*, DAOM *2529*, F; T *7921*, JWG *406*; T *7922*; JWG *235*; JWG *296*; JWG *628 ex* LOO *18873*.

EUROPE: **Sweden:** Uppsala, JWG *577*.—**Austria:** Neuchatel, T *ex* Herb. Barbey-Boissier *1120*;—Nassau, T *ex* Herb. Barbey-Boissier *1121*, F.

This species was originally described by Persoon (**1822**) as *Peziza Ariae* and was recognized by Fries (**1822**) as *Tympanis Ariae*. The combination *Dermea Ariae* usually has been ascribed to Tulasne, but was apparently actually first used by Karsten (**1871**) who cited Tulasne (**1865**) as the authority. However, while Tulasne did give an account of both perfect and imperfect stages in this work, and made it perfectly clear that he considered the fungus to belong in *Dermea*, he did not actually make the combination but referred to it as *Cenangium Ariae*.

Neither Persoon nor Fries cited any specimens, but both

Tulasne and Karsten cited Moug. & Nestl. Stirp. Crypt. Vog. *888*. The specimen in the Farlow Herbarium under this number is identical with my collections.

The fungus was apparently re-named *Tympanis inconstans* by Fries (**1849**) and this name was taken up by Fuckel (**1870**) and transferred to *Cenangium*. Fuckel cited Scler. Suec. *106* and Fung. Rhen. *1761*. Rehm (**1889**) stated that the fungus was *D. Ariae*, and although I have not seen the specimen in Scler. Suec. an examination of the specimen of Fung. Rhen. *1761* in the Farlow Herbarium has confirmed Rehm's opinion.

Groves (**1940**) has shown that *Cenangium subnitidum* Cke. & Phill. was based on a misdetermination of the host and is also a synonym of *D. Ariae*.

The conidial stage has received a number of names, many of which it has not been possible to verify with certainty and which must remain open to question. Von Höhnel (**1916**) compiled a list of synonyms of the conidial stage. No specimens of *Sphaeria conica* Alb. & Schw. have been examined but the original description stated that the fungus occurred on both *Prunus* and *Sorbus*, and since *D. Ariae* is not known to occur on *Prunus* it is doubtful whether *Sphaeria conica* is its conidial stage. A specimen labelled *Micropera Cotoneastri* Fr. in Syd. Myc. Germ. *1992* is the conidial stage of *D. Ariae* as is also a specimen in Fung. Columb. *571* labelled *Sphaeronema pallidum* Peck.

A specimen in Roumeguère Fung. Sel. Gall. Exs. *1722* labelled *Micropera Sorbi* (Lib.) Sacc. is also the conidial stage of *D. Ariae* but the citation is incorrect. It is stated on the label that the fungus is different from *Micropera Sorbi* Thüm., but von Thümen's name is based on Libert's species which was originally described as *Dothichiza Sorbi*. This fungus is not at all related to *Dermea* and according to von Höhnel (**1916**) is probably the conidial stage of a *Dothiora*. Saccardo (**1880**) made the combination *Micropera Sorbi* based not on *Dothichiza Sorbi* Lib. but on *Sphaeria Cotoneastri β Sorbi* Fries which evidently was the conidial stage of *D. Ariae*. Thus no such combination as *M. Sorbi* (Lib.) Sacc. ever existed.

Rhabdospora inaequalis (Sacc. & Roum.) Sacc. was also listed as a synonym by von Höhnel (**1916**) but examination of the speci-

men in Roum. Fung. Sel. Gall. Exs. *3273* in the herbarium of the Division of Botany and Plant Pathology, Ottawa, labelled *R. inaequalis*, yielded only a few brown, ellipsoid, two celled spores with no trace of the conidial stage of *D. Ariae*. However, the original description might apply to the conidial stage of *D. Ariae* and von Höhnel claimed to have found the fungus in the Roumeguère specimen which he examined; hence it may be that it is another synonym, and it may have just happened that the fungus was not present in the very meagre specimen in the Ottawa packet.

In nature the conidial fruiting bodies are more common and more conspicuous than the apothecia. The asci and ascospores are very similar to those of *D. bicolor* but the apothecia are generally smaller and more brownish in color. The conidia are also very similar in both species but in *D. Ariae* the fruiting bodies are pycnidium-like, usually containing a single cavity, whereas in *D. bicolor* they resemble *Micropera Drupacearum* in form. The two species are easily distinguished in culture by the color. Cultures of *D. Ariae* are usually rather bright colored whereas those of *D. bicolor* are whitish.

10. DERMEA HAMAMELIDIS (Peck) Groves, Mycologia **32**: 743. 1940. (FIGS. 17, 25, 41, 46.)

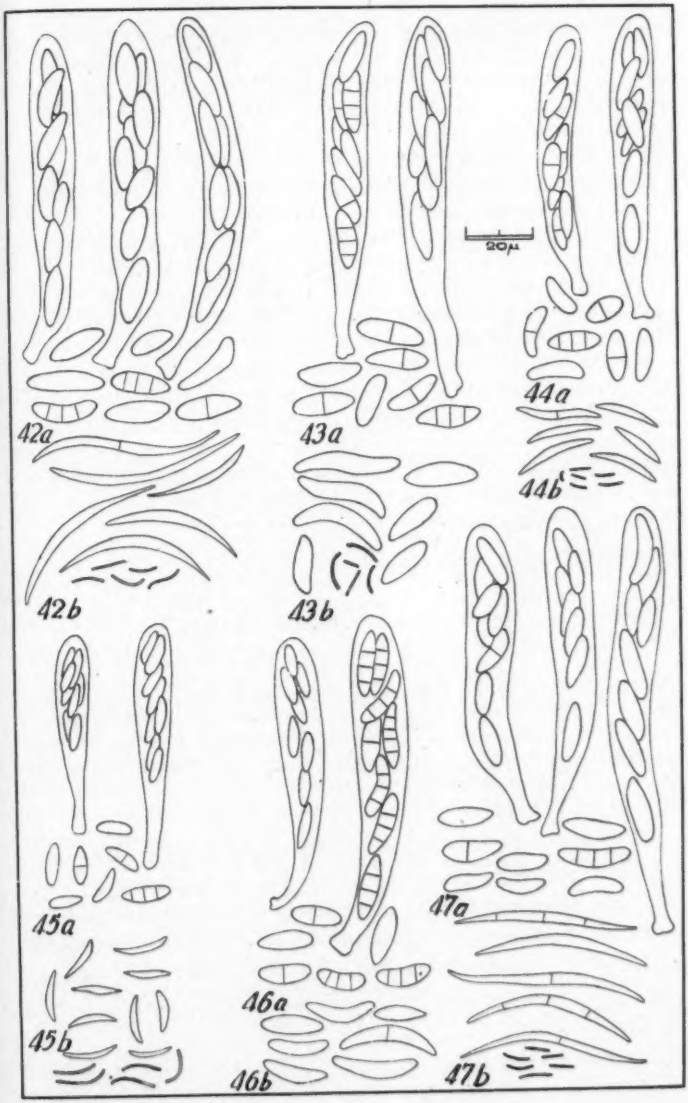
Patellaria Hamamelidis Peck, Ann. Rep. N. Y. St. Mus. **33**: 32. 1883.

Lecanidion Hamamelidis Sacc. Syll. Fung. **8**: 800. 1889.

Dermatella Hamamelidis Ellis & Ev. Proc. Philad. Acad. Sci. **45**: 149. 1893.

Dermatella Hamamelidis Durand, Bull. Torrey Club **29**: 464. 1902.

Apothecia erumpent, scattered or more or less in rows, separate or in small clusters, circular or somewhat undulate, sessile, narrowed below, 0.3–0.8 mm. in diameter, 0.2–0.4 mm. in height, dark reddish-brown to black, hard, leathery to horny in consistency, becoming more fleshy-leathery when moist, hymenium concave to plane or finally convex, slightly roughened, margin at first raised, later almost disappearing; tissue of the hypothecium compact, pseudoparenchymatous, composed of more or less elongated to almost isodiametric cells 5–12 μ in diameter, fairly thick walled, dark brown to almost hyaline, arranged in more or less vertically paral-



FIGS. 42–47. Species of *Dermea*.

lel rows, curving obliquely toward the outside where the cells are smaller, darker, and thicker walled; subhymenium a narrow zone of filamentous, interwoven hyphae; asci cylindric-clavate, short-stalked, eight spored, (70)80–100(120) × (10)12–15 μ; ascospores ellipsoid-fusiform, hyaline to yellowish, straight or slightly curved, irregularly biseriate, one to four celled, (13)15–20(22) × 5.0–7.5 μ; paraphyses hyaline, filiform, septate, simple or branched, 1.5–2.0 μ in diameter, the tips slightly swollen and glued together forming a yellowish epithecium.

Conidial fruiting bodies minute, about 150–200 μ in diameter, developing beneath the outer layers of bark and splitting them, appearing as small, thickly scattered, blister-like elevations in the bark with gray spore-masses emerging through them when moist; in section appearing as an acervulus-like structure with a thin basal layer about 5–8 μ in thickness, composed of hyaline, indistinct, slender, interwoven hyphae which curve upwards to form the hyaline, cylindric, simple conidiophores, 10–25 × 2.0 μ, tapering to a slender tip; conidia elongate-fusiform to subfiliform, hyaline, one or two celled, straight or curved, sometimes one end narrower and more curved than the other, (15)18–25(32) × 4.5–6.0 μ. No microconidia have been observed.

HOST: *Hamamelis virginiana* L.

EXSICCATI: Ell. N. Amer. Fung. *2634;* Fung. Columb. *2016.*

SPECIMENS EXAMINED: CANADA: **Ontario:** Toronto, T *4374,* JWG *57;* T *6565,* JWG *271;*—Erindale, JWG *162;*—Richmond Hill, DAOM *3991,* F, T *7928.*

UNITED STATES: **New Hampshire:** Chocorua, Aug. 20, 1907, F; Aug. 31, 1907, F.—**New York:** Pixley's Falls, T, JWG *285;*—Ithaca, F, White *2392,* F; Durand *1212;*—N. Greenbush, Durand *6096,* type of *Patellaria Hamamelidis* Peck;—Lyndonville, Durand *1048.*—**Pennsylvania:** West Chester, F, type of *Dermatella Hamamelidis* E. & E.;—Stoyestown, JWG *661 ex* LOO *21692;*—Lycoming Co., JWG *667 ex* LOO *20139.*

D. Hamamelidis was originally described by Peck (**1883**) as a *Patellaria* and was transferred to *Dermatella* by Durand (**1902**). Ellis and Everhart (**1893**) described it independently as a new species of *Dermatella.* The types of both *Patellaria Hamamelidis* Peck and *Dermatella Hamamelidis* Ell. & Ev. have been examined and are the same fungus. The species was transferred to *Dermea* by Groves (**1940**).

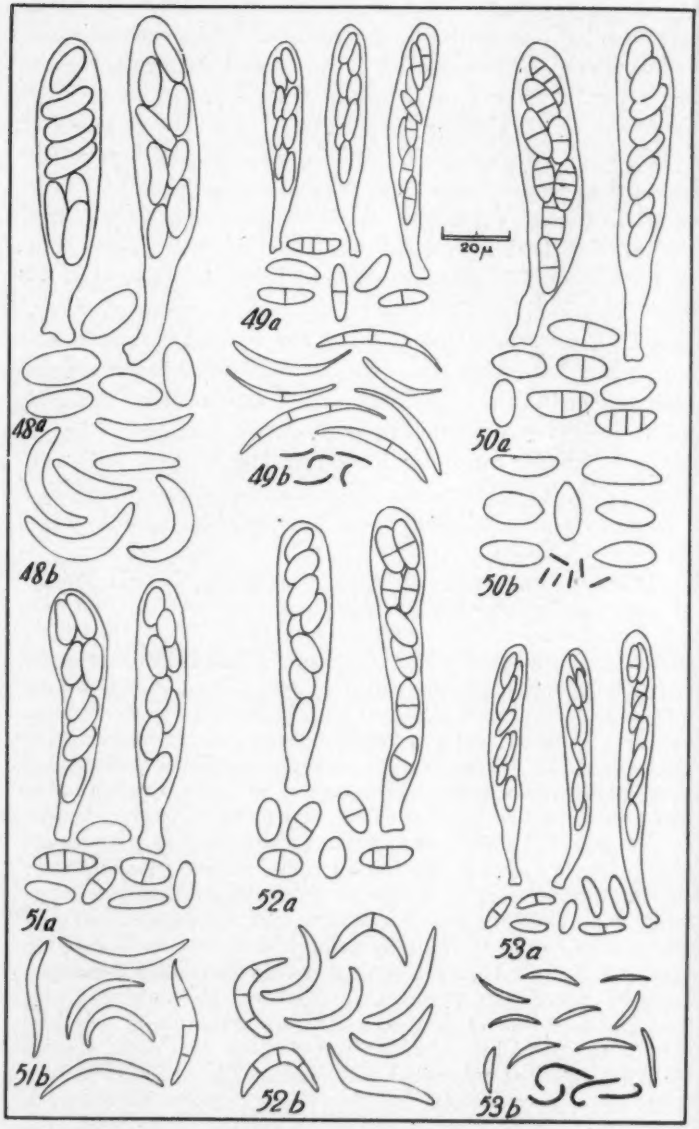
The genus *Dermatella* was erected by Karsten (**1871**) based on *D. Frangulae* and was separated from *Dermea* by having septate ascospores. *D. Frangulae* has apothecia which become dark col-

ored and resemble apothecia of *Dermea*, especially in the dried condition, but they are softer in consistency, and when moist are lighter colored. The asci are four spored and the ascospores are more broadly ellipsoid than those of *Dermea* species, resembling ascospores of *Pezicula* more closely in shape. Wollenweber (**1939**) studied this species in culture, and the conidial stage which he found appears to be closer to *Cryptosporiopsis* than to *Micropera*. In general, the affinities of this fungus appear to be nearer *Pezicula* than *Dermea*, and *Dermatella* is, therefore, considered to be a synonym of *Pezicula*. Septation of the ascospores is of no significance in either *Pezicula* or *Dermea* as a generic character.

In *D. Hamamelidis* both apothecia and conidial fruiting bodies are small and inconspicuous. The conidial fruiting bodies are the simplest found in any of the species of *Dermea* studied. This and the five following species form a group that is characterized by the relatively broader conidia with more bluntly rounded ends. *D. Hamamelidis* is easily recognized in culture by the firm, heaped-up, slow-growing colonies, usually with little aerial mycelium.

11. DERMEA CHIONANTHI Ell. & Ev. Proc. Acad. Nat. Sci. Philad. **45**: 148. 1893. (FIGS. 10, 40, 48.)

Apothecia erumpent, gregarious, more or less in rows, separate or cespitose, sessile, slightly narrowed below, circular or undulate, 0.4–1.0 mm. in diameter, 0.2–0.4 mm. in height, slightly furfuraceous to glabrous, dark reddish-brown or olivaceous-brown to black, hard, brittle, leathery to horny in consistency, becoming more fleshy when moist; hymenium at first concave, becoming plane to slightly convex, reddish-brown to black, slightly roughened and cracked, margin at first raised and prominent, later almost disappearing; tissue of the basal stroma compact, pseudoparenchymatous, composed of hyaline to brownish, thick-walled, gelatinized cells about 7–18 μ in diameter, the walls about 2–4 μ in thickness, arranged in vertically parallel rows, curving toward the outside where the cells are smaller and thicker-walled forming a brownish, pseudoparenchymatous excipulum; subhymenium a narrow, indefinite zone of slender, interwoven hyphae; asci cylindric-clavate, narrowed below, with a rather short stalk, eight spored, 90–110 × 15–20 μ; ascospores ellipsoid to ellipsoid-fusiform, hyaline becoming yellowish, one or two (probably four) celled, straight or slightly curved, irregularly biseriate, 18–25 × (6)7–



FIGS. 48–53. Species of *Dermea*.

9μ; paraphyses hyaline, filiform, septate, simple or occasionally branched, 1.5–2.5 μ in diameter, the tips slightly swollen up to 3–4 μ and forming an epithecium.

Conidial fruiting bodies erumpent, separate, black, about 0.2–0.4 mm. in diameter and 0.2 mm. in height, rounded, somewhat irregular to slightly conical, tearing open widely at the top, fleshy-membranous, becoming more fleshy when moist, containing a single cavity the base of which is lined with conidiophores, tissue prosenchymatous below, composed of more or less vertically parallel to slightly interwoven hyphae about 2.5–3.0 μ in diameter, becoming pseudoparenchymatous above, composed of darker, thick-walled, gelatinized cells about 5–7 μ in diameter; conidiophores hyaline, cylindric, simple or occasionally branched, continuous or septate, tapering to a fine point at the tip where the spore is borne, often swollen just below the tapering tip, 12–30 × 3–4 μ; conidia elongate-fusiform to subfiliform, hyaline, curved, sickle-shaped to almost straight, one or two celled, bluntly pointed at the ends, 25–35 × 5–7 μ; no microconidia observed.

HOST: *Chionanthus virginica* L.

EXSICCATI: Fung. Columb. *2423*.
SPECIMENS EXAMINED: UNITED STATES: **Delaware:** Wilmington, NYBG, type.—**Maryland:** Suitland, JWG *748 ex* USDA.

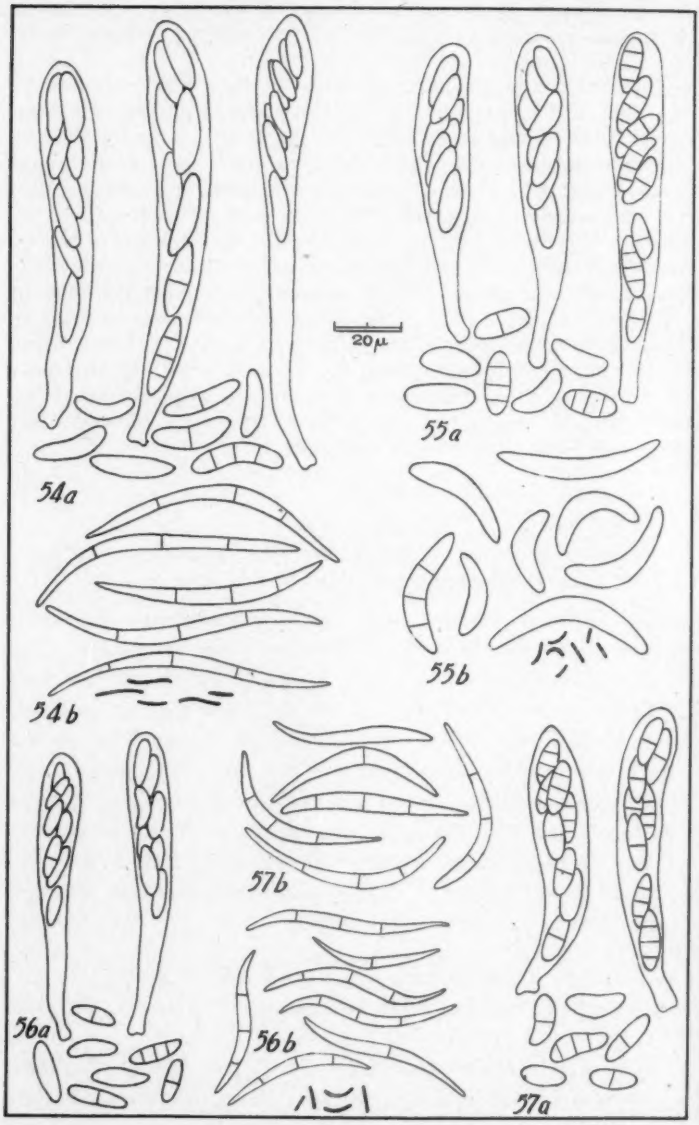
This is the only species of *Dermea* included in this paper which I have neither seen in fresh condition nor studied in culture. The type was kindly loaned by Dr. F. J. Seaver and agreed very well with the specimens in Fung. Columb. *2423* and the Maryland collection which was received from Miss E. K. Cash. The conidial stage described above was found in the latter specimen and although the connection has not been proved culturally, the nature of its association with the apothecia and its similarity to conidial stages of closely related species of *Dermea* leave little doubt of its relation to *D. Chionanthi*. The conidial fruiting bodies, although inconspicuous, are much better developed than in *D. Hamamelidis*.

12. **Dermea Tulasnei** nom. nov. (FIGS. 13, 14, 37, 55.)

Cenangium Fraxini sensu Tul. Ann. Sc. Nat. III, **20**: 140. 1853.

Cenangella Fraxini sensu Sacc. Consp. gen. Disc. p. 9. 1884.

Dermea Fraxini sensu Rehm, Ber. Bayer. Bot. Ges. **13**: 196. 1912.



FIGS. 54–57. Species of *Dermea*.

Dermea Fraxini sensu v. Höhn. Fragm. z. Myk. No. 914. 1915. St. conid.

Fusicoccum cryptosporioides Bomm., Rouss., Sacc. Contr. Myc. Belg. **4**: 80. 1891.

Micropera cryptosporioides v. Höhn. Fragm. z. Myk. No. 914. 1915.

Apothecia erumpent, scattered, separate or in small clusters, circular or slightly undulate, sessile, slightly narrowed below, 0.5–1.0 mm. in diameter, 0.2–0.6 mm. in height, hard, waxy-leathery to horny in consistency, becoming more fleshy when moist; hymenium concave to plane or slightly convex, dark reddish-brown to almost black, at first with a slightly raised, paler margin which later almost disappears; tissue compact, pseudoparenchymatous, composed of thick-walled cells 5–12 μ in diameter, in the upper part more elongated and somewhat interwoven, the excipulum composed of darker, isodiametric cells in obliquely parallel rows; subhymenium a narrow zone of slender, closely interwoven hyphae; asci cylindric-clavate, tapering into a short stalk, eight spored, (75)85–100(115) × 14–18(20) μ; ascospores hyaline to pale yellowish-green, ellipsoid-fusiform, straight or slightly curved, one to four celled, irregularly biseriate, (13)15–20(22) × 6–8(10) μ; paraphyses hyaline, filiform, septate, usually branched, 2.0–3.0 μ in diameter, the tips slightly swollen and glued together forming a yellowish epithecium.

Conidial fruiting bodies erumpent, scattered, rounded to short-conical, 150–500 μ in diameter, 200–400 μ in height, sometimes in elongated clusters up to 1 mm. in length, dark reddish brown to black, consistency a little softer than the apothecia, in the upper part containing one or sometimes several, more or less ovoid, simple to slightly chambered cavities which tear open irregularly at the top; tissue pseudoparenchymatous, composed of slightly colored, irregular, thick-walled cells 5–12 μ in diameter, and arranged in more or less vertically parallel rows, curving toward the outside; conidiophores cylindric, continuous or septate, sometimes slightly constricted at the septa, simple or branched, pointed at the tip, 25–50 × 4–5 μ; conidia hyaline to pale yellowish green, elongate-fusiform, scarcely subfiliform, one celled or occasionally septate, strongly curved to almost straight, 25–40(50) × (5.5)6–8 μ.

HOST: *Fraxinus nigra* Marsh., *Fraxinus* spp.

SPECIMENS EXAMINED: CANADA: **Quebec:** Burnet, DAOM *4556*, JWG *545*;—Ile Jésus, DAOM *7340*.—**Ontario:** Timagami Forest Reserve, T *8426*, JWG *177*; T *7927*, JWG *305*; T *7653*, JWG *403*, F;—Toronto, T

8431, 8448, JWG *457,* F; JWG *468;*—Petawawa For. Exp. Stn., DAOM *5217,* JWG *573;* JWG *810.*

The nomenclature of this and related Discomycetes occurring on *Fraxinus* has been much confused. The earliest name is *Peziza Fraxini* Schw., published in 1822. A fragment of the type of this species in the Durand Herbarium, Cornell University, was seen and it is the fungus now known as *Durandiella Fraxini* (Schw.) Seaver which has the gross appearance of a *Tympanis* but has filiform ascospores. In the Systema Mycologicum (**1822**) Fries recognized Schweinitz' species under the name of *Tympanis Fraxini.*

Tulasne (**1853**) described a fungus on *Fraxinus* which he referred to as *"Cenangium Fraxini* Nob. (*Tympanis Fraxini* Fr., S. M. II, 174)." Thus Tulasne evidently thought his fungus was *Tympanis Fraxini* Fr. although from his account it is clear that he had the *Dermea* and not the *Durandiella.* Therefore, Tulasne's combination was based on a misdetermination and according to Article 54 of the International Rules his combination must be regarded as a synonym of *Peziza Fraxini* Schw.

The error was perpetuated by Saccardo (**1884**) who based his genus *Cenangella* on Tulasne's fungus and called it *Cenangella Fraxini* (Tul.) Sacc.; and also by Rehm (**1912**) and von Höhnel (**1915**) who each transferred it to *Dermea* independently. Since all of the names are based on the specific epithet *Fraxini* which is ultimately based on Schweinitz' type, they must all be considered as synonyms of *Durandiella Fraxini.* The *Dermea* is thus left without a name and it is necessary to give it a new name.

It is evident from the descriptions given by Rehm (**1889**) and Phillips (**1893**) that a true *Tympanis* species with multispored asci also occurs on *Fraxinus* in Europe and has been referred to *Tympanis Fraxini* also. It would seem that the correct name of this *Tympanis* is *T. columnaris* (Wallr.) v. Höhn.

Dermatella Fraxini Ell. & Ev. is based on a different type and the specific name is, consequently, valid. A portion of the type in the Durand Herbarium *7369* was examined but no asci or ascospores were found. The specimen in Ellis N. Amer. Fung. *2633* is apparently a later collection from the same locality as the type and is similar in gross appearance. This fungus is a *Pezicula.*

D. Tulasnei appears to be rare and it is difficult to find it in abundance. The apothecia are softer in consistency than most *Dermeae* and approach the genus *Pezicula* in this respect. As noted above it is morphologically close to *D. Chionanthi* in both perfect and imperfect stages.

13. **Dermea pinicola** sp. nov. (FIGS. 15, 51.)

Apotheciis erumpentibus, gregariis, solitariis vel caespitosis, orbicularibus vel undulatis, sessilibus, versus basim attenuatis, 0.3–0.5(0.8) mm. diam., 0.2–0.4 mm. altis, brunneis vel atris, coriaceis vel corneis in sicco, carnoso-coriaceis in humido; hymenio concavo vel plano, marginato; hypothecio pseudoparenchymato; ascis cylindraceo-clavatis, breve stipitatis, octosporis, (60)70–90(100) × (12)14–17(20) μ; ascosporis ellipsoideis vel ellipsoideo-fusiformibus, hyalinis, rectis vel laeve curvulis, continuis vel uniseptatis, 13–18(20) × 5–7.5 μ; paraphysibus hyalinis, filiformibus, septatis, simplicibus vel ramosis, 1.5–2.0 μ diam., apice leviter incrassatis, agglutinatis, epithecium formantibus.

Hab. *Pinus Strobus* L.

Apothecia erumpent, gregarious to scattered, separate or in small clusters of two to six, circular or slightly undulate, sessile, narrowed below, 0.3–0.5(0.8) mm. in diameter, 0.2–0.4 mm. in height, dark reddish-brown to black, hard, leathery to horny in consistency, becoming more fleshy-leathery when moist, hymenium concave to plane or slightly convex, slightly roughened, the margin at first raised and somewhat inrolled, later almost disappearing, a little paler than the hymenium; tissue of the hypothecium compact, pseudoparenchymatous, composed of pale brownish, thick-walled, almost isodiametric, angular cells mostly 5–8 μ in diameter, arranged in more or less vertically parallel rows, curving obliquely to the outside where the walls are thicker, sometimes the cells more elongated in the upper central part; subhymenium indistinct; asci cylindric-clavate, short-stalked, eight spored, (60)70–90(100) × (12)14–17(20) μ; ascospores ellipsoid to ellipsoid-fusiform, hyaline, straight or slightly curved, one or two celled, irregularly biseriate, 13–18(20) × 5.0–7.5 μ; paraphyses hyaline, filiform, septate, simple or branched, 1.5–2.0 μ in diameter, the tips slightly swollen to 3 μ and glued together forming an epithecium.

HOST: *Pinus Strobus* L.

TYPE: West mainland, Lake Timagami, Ont. Aug. 24, 1935. DAOM *14973*.

SPECIMENS EXAMINED: CANADA: **Ontario:** Timagami Forest Reserve, JWG *317;* DAOM *14973*, JWG *402*, T.

UNITED STATES: **Vermont:** Dummerston, JWG *803*.

This species appears to be rare. It has only been collected twice and a third specimen was found on one twig in a collection of a *Tympanis* species on pine received from J. R. Hansbrough (JRH *1510*). This is the only species in which no conidial stage has been found in nature, but cultures from ascospores produced a *Micropera* stage.

The conidial fruiting bodies, both on agar and on sterilized twigs of the host, develop as rounded, fleshy stromata, which are glabrous or covered with a short, downy to tomentose mycelium. They are mostly about 0.5 mm. in diameter, sometimes larger, and usually contain a single cavity. The conidiophores are hyaline, cylindric, septate, simple or branched, and measure 20–45 × 3–4 μ. The conidia are elongate-fusiform to subfiliform, hyaline, sometimes becoming yellowish, mostly sickle-shaped, or nearly straight to sigmoid, one end more pointed than the other, one to four celled, and measure (25)30–40(50) × 4–6 μ.

Among the various species of fungi reported on pine as species of *Dermea* or related genera, the only one which seems close to this species is *D. microspora* Vel. However, apothecia of the latter are described as 0.2–0.4 mm. in diameter, the asci 70–80 × 10 μ, and the ascospores as 12–15 μ in length with the width not stated. Except for the diameter of the asci, these dimensions agree fairly well with my species. It has not been possible to see any specimens of *D. microspora* and until the two are compared it will be impossible to say with certainty whether or not they are identical. In the meantime it seems preferable to consider the North American fungus as distinct.

14. **Dermea piceina** sp. nov. (FIGS. 11, 12, 32, 52.)

Apotheciis erumpentibus, dispersis, solitariis vel caespitosis, orbicularibus vel undulatis, sessilibus, versus basim attenuatis, 0.5–1.5 mm. diam., 0.5–1.0 mm. altis, brunneis vel atris, coriaceis vel corneis in sicco, carnoso-coriaceis in humido; hymenio concavo dein plano vel convexo, olivaceo-brunneo vel rubro-brunneo vel atro, marginato; hypothecio plectenchymato; ascis cylindraceo-clavatis, octosporis, breve stipitatis, 75–105 × (12)14–16(17) μ; ascosporis ellipsoideis vel ellipsoideo-ovoideis, primo hyalinis, dein fuscis, continuis vel triseptatis, rectis vel leviter curvulis, (11)12–14(18) × (5)6–8 μ; paraphysibus hyalinis, filiformibus, septatis, simplicibus vel ramosis, 1.5–2.0 μ diam., apice leviter incrassatis, epithecium formantibus.

Hab. *Picea glauca* Voss.

Apothecia erumpent, scattered, separate or cespitose in small clusters of about two to six, circular or slightly undulate, sessile, narrowed below to substipitate, 0.5–1.5 mm. in diameter, 0.5–1.0 mm. in height, dark reddish-brown to black, hard, leathery to horny in consistency, becoming more fleshy-leathery when moist; hymenium at first concave, soon plane to convex, slightly furfuraceous, dark olive-brown to dark reddish-brown to almost black, at first with a darker, slightly raised margin which later may disappear; tissue compact, plectenchymatous, composed of interwoven, ascending hyphae about 3–5 μ in diameter, the walls brown or purple-brown, somewhat thickened and gelatinized, almost vertically parallel in the central part, curving obliquely toward the outside where the walls are thicker and darker and the hyphae closely septate, forming a pseudoparenchymatous zone of several cells thickness, the cells about 3–6 μ in diameter; subhymenium a narrow zone of hyaline, interwoven hyphae; asci cylindric-clavate, short stalked, eight spored, 75–105 × (12)14–16(17) μ; ascospores ellipsoid to ellipsoid-ovoid, hyaline becoming brownish, one or two (to four) celled, irregularly biseriate to crowded, (11)12–14(18) × (5)6–8 μ; paraphyses hyaline, filiform, septate, simple or branched, 1.5–2.0 μ in diameter, the tips slightly swollen up to 3 μ, forming a slight epithecium.

Conidial fruiting bodies erumpent, scattered, mostly single, minute, black or greenish-black, glabrous, 0.1–0.3 mm. in diameter, almost globose, opening at the tip and the spores emerging in a whitish to pale greenish mass or cirrhus, tissue plectenchymatous, composed of interwoven, ascending hyphae curving outward and upward around the ovoid cavity in the upper part, with a pseudoparenchymatous zone at the outside composed of cells 3–7 μ in diameter; conidiophores lining the cavity, hyaline, cylindric, pointed at the tip, septate, simple or branched, 15–30 × 2–3 μ; conidia elongate-fusiform, hyaline, strongly curved to nearly straight or occasionally sigmoid, pointed at the ends, one end usually more pointed than the other, one to four celled, 22–40 × 3–5 μ; microconidia hyaline, filiform, one celled, strongly curved, ends rounded, 9–15 × 1.0–1.5 μ.

HOST: *Picea glauca* Voss.

TYPE: Petawawa Forest Experiment Station, Ontario, Sept. 2, 1943. DAOM *14974*.

SPECIMENS EXAMINED: CANADA: **Ontario:** Petawawa Forest Experiment Station, DAOM *14974*, JWG *793*; JWG *770*.

This species was first collected in September, 1942 but very little material was found. The following year a special search was

made for it in the same locality and a good collection was obtained. It is close to *D. pinicola* but the ascospores of the latter tend to be more fusoid whereas those of *D. piceina* are more ellipsoid and rounded at the ends, and a little broader in proportion to their length. The conidia are very similar in the two species but slightly broader in *D. piceina,* which has slightly larger and more scattered apothecia. Both species appear to be rare.

None of the fungi described on *Picea* as species of *Dermea* or related genera agrees with this species as far as could be ascertained. The description of *Dermea Pini* Otth, which has been reported on *Picea excelsa,* is too meagre to enable the fungus to be recognized and it has not been possible to see any specimens. It is described as having a *Micropera*-like conidial stage but the conidia as described are longer and narrower than those of *D. piceina.*

D. piceina was found on the mature bark of trunks of fallen trees and is quite inconspicuous. The conidial fruiting bodies are very small and can be most easily detected by leaving the material in a moist chamber over night and searching for the fresh spore horns. The cultures somewhat resemble those of *D. molliuscula* and *D. Prunastri* but the conidia are very different from both of these species.

15. DERMEA PRUNASTRI (Pers. *ex* Fr.) Fr. Summ. Veg. Scand. p. 362. 1849. (FIGS. 5, 6, 28, 43.)

Peziza Prunastri Pers. Tent. disp. meth. p. 35. 1797.

Cenangium Prunastri Fr. Syst. Myc. **2**: 180. 1822.

Tympanis Prunastri Wallr. Flor. Crypt. Germ. **2**: 427. 1833.

Phaeangella Prunastri Massee, Brit. Fung. Fl. **4**: 137. 1895.

Dermatella Prunastri Dowson, New Phytol. **12**: 207. 1913.

St. conid.

Ceratostoma spurium Fr. Obs. Myc. **2**: 338. 1818.

Sphaeronema spurium Sacc. Syll. Fung. **3**: 186. 1884.

Micropera spuria v. Höhn. Fragm. z. Myk. No. 950. 1916.

Sphaeria rigida DC. Fl. Fr. **6**: 132. 1815.

Cenangium Prunastri β rigida Fr. Syst. Myc. **2**: 180. 1822.

? *Cenangium rigidum* Schw. Syn. Fung. p. 238. 1832.

? *Dendrophoma fusispora* v. Höhn. Fragm. z. Myk. No. 21. 1902.

? *Micropera fusispora* v. Höhn. Mitt. Bot. Lab. Techn. Hochsch. in Wien 1: 24. 1924.

Apothecia erumpent, scattered, cespitose, occasionally single, sessile, narrowed below, circular or undulate, 0.5–1.0(1.2) mm. in diameter, 0.2–1.0 mm. in height, dark brown to black, hard, leathery to horny in consistency, becoming more fleshy-leathery when moist; hymenium concave to plane or slightly convex, black, roughened, margin at first thick, raised, sometimes incurved, brownish, later almost disappearing; tissue of the hypothecium compact, pseudoparenchymatous, composed of more or less elongated to almost isodiametric cells 7–15 μ in diameter with thickened and gelatinized walls, toward the outside arranged in more or less oblique rows and darker walled; subhymenium a narrow zone of more slender, closely interwoven hyphae; asci cylindric-clavate, short stalked, eight spored, (80)90–115(125) × (10)12–14(15) μ; ascospores ellipsoid-fusiform, hyaline, becoming yellowish, one to four celled, straight or slightly curved, irregularly biseriate, (12)15–20 (25) × 5.0–7.5 μ; paraphyses hyaline, filiform, septate, simple or branched, 1.5–2.0 μ in diameter, the tips slightly swollen to 2.5–3.0 μ and glued together forming a yellowish epithecium.

Conidial fruiting bodies erumpent, cespitose, occasionally single, cylindric to cylindric-conic or subulate, 1–2 mm. in height, 0.2–0.4 mm. in diameter at the base, arising from a more or less circular to transversely elongated basal stroma, black to greenish or olivaceous when moist, glabrous, hard, horny, brittle, becoming more fleshy-leathery when moist, containing a single, ovoid cavity which is frequently in the tip of the beak only but may extend down into the basal stroma, tissue of the basal stroma similar to that of the apothecia, the cells in the beak arranged in more or less vertically parallel rows; conidiophores hyaline, cylindric, tapering to a slender point, septate, simple, 20–35 × 2.5–3.0 μ; conidia elongate-fusiform, hyaline to slightly greenish-yellow, one celled, almost straight to slightly sickle-shaped, occasionally sigmoid, ends pointed, (15)20–30(35) × (4.0)5.0–7.0 μ; microconidia hyaline to yellowish, filiform, straight or slightly curved, one celled, ends rounded, 7–10 × 1.5 μ.

HOST: *Prunus* spp.

EXSICCATI: Fung. Col. *3118* (*D. Cerasi*); Jaap Fung. Sel. Exs. *605*.

SPECIMENS EXAMINED: CANADA: **Nova Scotia:** Colchester Co., JWG *798 ex* LEW *1692*.—**Quebec:** St. Alphonse, DAOM *3789*; DAOM *3793*;—Duchesnay, JWG *597*;—Ile Jésus, JWG *733*;—Eardley, DAOM *4681*, JWG *562*, F.—**Ontario:** Timagami Forest Reserve, T *4382*, JWG *8*; T *6568*,

JWG *227;* T *6984,* JWG *284;* T *6594,* F; JWG *174;* JWG *225;* JWG *242;* JWG *333;* JWG *425,* DAOM *2542,* F; DAOM *2527;*—Toronto, T *4381,* JWG *2;* JWG *84;*—Petawawa For. Exp. Stn., DAOM *4713.*

UNITED STATES: **South Carolina:** F.—**New Hampshire:** Mason, JWG *774 ex* Darker *6854.*—**New York:** Buffalo, F.—**Idaho:** Bonner Co., JWG *759,* DAOM *12059;* JWG *760.*—**Washington:** Marysville, F;—Bremerton, DAOM, F *ex* USDA *1402* (*D. Cerasi*).

EUROPE: **Germany:** Leipzig F, *ex* Herb. Barbey-Boissier *1111.*

This species was discussed under *D. Cerasi.* It has not been possible to examine any type material and the identification rests chiefly on the descriptions of the conidial stage. However, this is so characteristic that there seems little doubt of the identity of the fungus. It has been well illustrated by Arnaud (**1931,** pp. 1330–1334).

Dowson (**1913**) showed that this species was the cause of a die-back of greengage plums. He referred to it as *Dermatella Prunastri* Pers., but Dowson's paper appears to be the first in which the fungus was called *Dermatella.* The only citation he gave as authority for this name is the following statement: "Rabenhorst, referring to it as *Dermatella Prunastri,* considers the group genus *Dermatea* to be subdivided into three subgenera of which *Dermatella* is the third, the others being *Eudermatea* and *Pezizicula.*" Presumably he meant Rehm's account in Rabenhorst's Kryptogamen Flora, but Rehm used *Dermatella* only as a subgenus and the fact that he placed this fungus there as *D. Prunastri* does not indicate that he intended to make a *Dermatella* combination. This is obvious when compared with his treatment of the species placed under the subgenus *Pezicula* to which he also referred under the initial *D.* Evidently, therefore, Dowson himself must be considered as the author of this combination. Certainly, there is no justification for ascribing it to Persoon.

The conidial stage may be found fairly frequently on small, dead twigs of *Prunus* but the apothecia occur less often. They are smaller and usually more cespitose in growth habit than either *D. Cerasi* or *D. Padi* but the asci and ascospores are very similar in all three. The conidial fruiting bodies and the size and shape of the conidia provide the best distinguishing characters. Cultures of *D. Prunastri* can be distinguished easily from the other two by

their yellowish to olive color, firm consistency and relatively slow rate of growth.

16. DERMEA ACERINA (Peck) Rehm, Ber. Bayer. Bot. Ges. **13**: 197. 1912. (FIGS. 16, 36, 50.)

Tympanis acerina Peck, Ann. Rep. N. Y. St. Mus. **31**: 48. 1879.

Scleroderris acerina Sacc. Syll. Fung. **8**: 599. 1889.

? *Patellaria acericola* Atk. in herb. Mycologia **32**: 810. 1940.

? *Lecanidion acericolum* Atk. in herb. Ann. Rep. N. Y. St. Mus. **49**: 24. 1896.

St. conid.

Sphaeronema acerinum Peck, Ann. Rep. N. Y. St. Mus. **24**: 86. 1872.

Sphaeronema nigripes Ellis, Bull. Torrey Club **6**: 107. 1876.

Naemosphaera acerina von Höhnel, Fragm. z. Myk. No. 959. 1916.

Apothecia erumpent, scattered, sometimes in rows, separate or in small clusters, circular or undulate, 0.4–1.0 mm. in diameter, 0.2–0.5 mm. in height, sessile, narrowed below, black or dark brownish, hard, leathery to horny in consistency, becoming more fleshy-leathery when moist; hymenium at first concave, becoming plane or slightly convex, the margin at first thick, raised, later almost disappearing, usually slightly paler than the disc; tissue of the hypothecium compact, pseudoparenchymatous, composed of brownish, almost isodiametric to slightly elongated cells 4–8 μ in diameter, toward the outside arranged in oblique rows with the walls thick and dark, but in the central part more elongated and interwoven; asci cylindric-clavate, short stalked, eight spored, (70)85–110(125) × (10)13–16 μ; ascospores oblong-ellipsoid to ellipsoid-fusiform, hyaline becoming yellowish, one to four celled, straight or sometimes slightly curved, irregularly biseriate to uniseriate, 13–20 × 5–8 μ; paraphyses hyaline, filiform, septate, simple or branched, 1.5–2.0 μ in diameter, the tips slightly swollen and glued together forming a yellowish epithecium.

Conidial fruiting bodies erumpent, usually in long rows, separate, sometimes cespitose in small clusters, subulate, basal stroma subglobose to ovoid, 0.2–0.5 mm. in diameter, dark brown to black, hard, leathery to horny in consistency, more fleshy-leathery when moist; the beak slender, tapering, straight or sometimes curved, brittle, up to 1.5 mm. in length and 100–150 μ in diameter at the

base and tapered to 50–75 μ at the tip, dark brown to black at the base, becoming paler and often somewhat translucent toward the tip; tissue of the basal stroma pseudoparenchymatous, composed of yellowish-brown cells 5–8 μ in diameter, somewhat more elongated around the cavity, the beak composed of hyaline to pale brownish, parallel hyphae about 1.5–2.0 μ in diameter; the cavity ovoid, 150–175 × 225–250 μ, filled with numerous, hyaline, branched, hair-like paraphyses about 1.0 μ in diameter and embedded in a slimy material; conidiophores hyaline, cylindric, continuous or septate, simple, 20–40 × 2.0 μ, often swollen to 3–4 μ below the pointed tip; conidia oblong-ellipsoid, hyaline, straight or sometimes slightly curved, one celled, ends rounded, one end with a truncate apiculus, sometimes one end narrower than the other, 15–25 × 5–8 μ; microconidia hyaline, filiform, one celled, straight or curved, 6–10 × 1.0–2.0 μ.

HOST: *Acer* spp., *A. rubrum* L., *A. saccharum* Marsh., *A. saccharinum* L.

EXSICCATI: Rel. Farl. *143;* Fung. Columb. *2086; 3585;* N. Amer. Fung. *947; 3441;* Syd. Fung. exot. exs. *429.*

SPECIMENS EXAMINED: CANADA: **Nova Scotia:** Casey's Corners, DAOM *4652,* JWG *558.*—**Quebec:** Duchesnay, DAOM *5305,* JWG *602;* DAOM *5310,* JWG *595;*—MacDonald College, DAOM *7326;*—Kingsmere, JWG *113;* Hull, JWG *128.*—**Ontario:** Timagami Forest Reserve, T *3006,* JWG *71;* T *3524,* JWG *22;* T *3531,* JWG *49;* T *4472;* T *6563,* JWG *260,* F; T *6577,* JWG *247;* T *6958,* JWG *259;* T *7281;* T *7913;* T *7914;* T *7915,* JWG *396;* T *7916;* JWG *246;* JWG *316;* JWG *487;*—Toronto, T *6562,* JWG *273;* T *7398,* JWG *134;* T *7399,* JWG *681;* T *7917;* JWG *52;* JWG *53;* JWG *94;*—Peel Co., T *6109;*—Brant Co., T *8433;*—Ottawa, T *4839,* JWG *108;* JWG *109;* DAOM, JWG *130;*—Petawawa For. Exp. Stn., DAOM *4695;* DAOM *7320,* JWG *718.*

UNITED STATES: **Virginia:** Mt. Lake, JWG *506.*—**Maine:** Mt. Katahdin, F, White *3522.*—**New York:** Griffins, Durand Herbarium *3022* (part of type);—MacLean, F, White *2393,* JWG *463.*—**Michigan:** Vermilion, DAOM *7593,* T.

This species was first described by Peck (**1879**) as *Tympanis acerina,* evidently on the basis of the gross appearance of the apothecia since it is very different in microscopic characters from members of this genus. The ascospores were described as three-septate and Saccardo (**1889**) transferred it to *Scleroderris* in order to place it in his system, although it is not at all similar to the urceolate species with narrow-fusoid ascospores usually referred

there. Rehm (**1912**) finally transferred it to *Dermea* where it seems advisable to leave it at present although it shows certain aberrant characters of which the most noteworthy is the shape of the conidia.

The oblong-ellipsoid conidia are similar in form to conidia of species of the related genus *Pezicula,* and this has led to confusion regarding the specific identity and conidial relations of this fungus and of species of *Pezicula* occurring on *Acer.* Groves (**1938, 1941**) has established the genetic connection of *D. acerina* and *Naemosphaera acerina* by cultural methods, and has shown that there are three distinct species of *Pezicula* occurring on *Acer,* all of which have conidial stages belonging to the form genus *Cryptosporiopsis,* and which can be distinguished by the gross appearance of the apothecia, the size of the asci and ascospores, and the size of the conidia.

D. acerina is frequently found growing closely associated with *Pezicula carnea* (Cke. & Ell.) Rehm but can be readily distinguished from it by the color of the apothecia which are black in *D. acerina* and ochraceous buff in *P. carnea.* The conidial fruiting bodies of *D. acerina* are conspicuous, beaked pycnidia whereas in *P. carnea* they are very inconspicuous, fleshy stromata developing beneath the layers of outer bark.

In a sense, however, *D. acerina* does form a connecting link between *Dermea* and *Pezicula.* This is even more apparent when it is compared with *P. Frangulae.* In both of these species the apothecia are similar in gross appearance when dried and the ascospores and conidia of both species are similar in form. It is, perhaps, questionable whether *P. Frangulae* should not be retained in *Dermea* also. However, when moistened its apothecia become more *Pezicula*-like. I have not studied *P. Frangulae* in culture but Wollenweber (**1939**) cultured it and considered it to be a *Pezicula* and this interpretation is accepted. It is evident that although the retention of both *Dermea* and *Pezicula* serves a useful purpose since both include a number of species apparently representative of different lines of development, it is difficult to draw a clear-cut separation between them.

GENERIC HOST INDEX

Abies
D. balsamea
Acer
D. acerina
Amelanchier
D. bicolor
Betula
D. molliuscula
Chionanthus
D. Chionanthi
Fraxinus
D. Tulasnei
Hamamelis
D. Hamamelidis
Ilex
D. Peckiana
Libocedrus
D. Libocedri
Nemopanthus
D. Peckiana
Picea
D. piceina
Pinus
D. pinicola
Prunus
D. Cerasi
D. Padi
D. Prunastri
Sorbus
D. Ariae
Tsuga
D. balsamea
Viburnum
D. Viburni

DOUBTFUL AND EXCLUDED SPECIES

Many fungi have been described in *Dermea* which do not truly belong there. An attempt has been made to bring together all the *Dermea* names in the literature and to account for them. Where possible the true relationships of the fungi will be indicated below, but with many of them it is impossible to even guess at their position until they have been more critically studied.

D. abietina Auersw. Tauschverein. 1865. This name is cited by Rehm (**1889**) as a synonym of *Pezicula eucrita* Karst. I have seen a specimen so labelled in Rab. Fung. Eur. *1027,* but could not find any fungus except what may have been the remains of a few old apothecia of a *Pezicula.* I have not seen any description.

D. abietina Vel. Mon. Disc. Bohem. p. 65, 1934. This species is known to me only by the description. It was said to be on *Abies* and the description agrees fairly well with *D. balsamea,* but it would be necessary to see authentic specimens before placing it in synonymy.

D. acericola (Peck) Cooke, Grev. **3**: 137, 1875 = *Pezicula acericola* (Peck) Sacc. Atti Ist. Ven. VI, **3**: 725, 1885.

D. acicola Briard & Sacc. Rev. Mycol. **7**: 159, 1885. This species was described as occurring on leaves of *Juniperus* and this habitat would exclude it from *Dermea.* I have seen no material.

D. Alni Rehm, Rab. Krypt.-Fl. I, **3**: 252, 1889 = *Pezicula Alni* Rehm, Ber. Bayer. Bot. Ges. **13**: 199, 1912.

D. amoena Tul. Bot. Zeit. **11**: 54, 1853 = *Pezicula amoena* Tul. Sel. Fung. Carp. **3**: 184, 1865.

D. atra Vel. Mon. Disc. Bohem. p. 65, 1934. This species, which was described on *Pinus,* is excluded from *Dermea* by reason of the long, cylindric, finally eight celled spores. Velenovsky described it under *Dermea* in the text but illustrated it as *Durella atra.*

D. aureo-tincta Rehm, Hedw. **39**: 84, 1900. Specimens in the Farlow Herbarium bearing this name are a large species of *Encoelia.* No other material has been seen.

D. australis (Speg.) Sacc. Syll. Fung. **8**: 554, 1889. This species was originally described as a *Cenangium* occurring on *Fagus.* The description does not suggest *Dermea* and no material has been seen.

D. australis Rehm, Rab. Krypt.-Fl. I, **3**: 254, 1889 = *Pezicula australis* Rehm, Ber. Bayer. Bot. Ges. **13**: 201, 1912.

D. Betulae Rehm, Rab. Krypt.-Fl. I, **3**: 1221, 1896 = *Pezicula Betulae* Rehm, Ber. Bayer. Bot. Ges. **13**: 200, 1912.

D. blumenaviensis P. Henn. Hedw. **41**: 18, 1902. This species was described on rotten wood from Brazil. The description does not suggest a *Dermea,* but no material has been seen.

D. brunneo-pruinosa Zeller, Mycologia **26**: 291, 1934 = *Pestalopezia brunneo-pruinosa* Seaver, Mycologia **34**: 300, 1942. This species is very close to *Velutaria* but was placed in a distinct genus by Seaver on the basis of the conidial stage. It occurs on *Gaultheria Shallon.*

D. caespitosa Fuckel, Symb. Myc. p. 277, 1870. This fungus was described as occurring on *Corylus,* but no authentic material has been seen. The description suggests an *Encoelia.* The spores would exclude it from *Dermea.*

D. carnea Cke. & Ell. Grev. **5**: 32, 1876 = *Pezicula carnea* Rehm, Ber. Bayer. Bot. Ges. **13**: 199, 1912.

D. carpinea (Pers.) Fr. Summ. Veg. Scand. p. 362, 1849 = *Pezicula carpinea* Tul. Sel. Fung. Carp. **3**: 183, 1865.

D. Cenangium (DeNot.) Rehm, Rab. Krypt.-Fl. I, **3**: 1256,

1896. This species, occurring on *Rhododendron,* is apparently a *Velutaria* but no authentic specimens have been seen.

D. cinnamomea (DC.) B. & Br. Ann. & Mag. Nat. Hist. ser. 5, **7**: 131, 1881 = *Pezicula cinnamomea* Sacc. Syll. Fung. **8**: 311, 1889.

D. cinnamomea Cke. & Peck, N. Y. St. Mus. Ann. Rep. **28**: 67, 1876 = *Ocellaria ocellata* (Pers.) Schroet. Krypt.-Fl. Schles. III, **2**: 150, 1908. Part of the type in the Durand Herbarium *3788* has been seen.

D. conigena Phill. Grev. **9**: 106, 1881. No material of this fungus has been seen but the color would exclude it from *Dermea.* It was described as occurring on cones of *Abies.*

D. constipata Starb. Bih. K. Svensk. Vet. Akad. Handl. **25**: 13, 1899. This fungus was described from Brazil on an unidentified host. The description does not suggest *Dermea* but no material has been seen.

D. Corni Phill. & Hark. Grev. **13**: 22, 1884 = *Pezicula Corni* Petr. Ann. Myc. **20**: 197, 1922.

D. corticola Arnaud, Rev. Path. Vég. **10**: 30, 1923 = *Pezicula corticola* Nannf. Nova Acta Reg. Soc. Sci. Upsal. ser. 4, **8**: 94, 1932.

D. Coryli Tul. Bot. Zeit. **11**: 54, 1853 = *Pezicula Coryli* Tul. Sel. Fung. Carp. **3**: 183, 1865.

D. Crataegi Jaap, Abh. Bot. Ver. Prov. Brandbg. **52**: 127, 1910. From specimens in Jaap Fung. Sel. Exs. *413* this is a *Pezicula* resembling *P. crataegicola* (Dur.) in gross appearance but with much smaller asci and spores. There is no valid name available for this fungus at present.

D. crataegicola Durand, Journ. Mycol. **10**: 100, 1904. The type of this species in the Durand Herbarium *2453* has been examined. It is a rather dark colored *Ocellaria*-like fungus, with large asci and ascospores. Its affinities seem to be closer to *Pezicula* than to *Dermea* and it should be called **Pezicula crataegicola** (Durand) n. comb.

D. Craterium Schw. Trans. Amer. Phil. Soc. II, **4**: 237, 1822 = *Urnula Craterium* Fries, Nova Acta Soc. Sci. Upsal. III, **1**: 122, 1851.

D. crypta Cooke, Grev. **16**: 70, 1888. The description of this species suggests a *Pezicula,* but no material has been seen.

D. cucurbitaria Cooke, in Ellis N. Amer. Fung. *68*, 1878 = *Triblidium cucurbitaria* Rehm, Ber. Naturh. Ver. Augsburg **26**: 78, 1881.

D. Cydoniae Schw. Syn. Fung. Amer. Bor. p. 237, 1832. A portion of the type of this species was kindly loaned by Mr. J. A. Stevenson. The fungus is not a discomycete. Some old fruiting bodies that may have been pycnidia or possibly perithecia were present, but no spores were found. The name should be dropped.

D. dimorpha Seaver, Mycologia **16**: 8, 1924. Authentic specimens of this species were kindly loaned by Dr. Seaver. The fungus is certainly not a *Dermea* but it is difficult to place it satisfactorily. It seems to be more closely allied to *Encoelia,* but it is not a typical member of this genus either. It should be compared with authentic material of *Cenangium episphaeria* Schw. Two specimens have been examined in the Farlow Herbarium under this name which were collected by Rick in Brazil. One is labelled *"Dermatea episphaeria"* but this combination does not appear to have been published. These two specimens are the same as Seaver's species, but no authentic Schweinitz specimen has been seen.

D. dissepta Tul. Bot. Zeit. **11**: 54, 1853 = *Pezicula dissepta* Tul. Sel. Fung. Carp. **3**: 187, 1865.

D. dryina Cooke apud Phillips, Man. Brit. Disc. p. 340, 1893 = *Pezicula dryina* Sacc. Syll. Fung. **8**: 313, 1889. A specimen of this fungus in the Durand Herbarium *145* has been examined. It occurs on *Quercus* and is a rather distinctive species, not fitting well in either *Dermea* or *Pezicula,* but closer to the latter.

D. endoneura Har. & Pat. Bull. Mus. d'hist. nat. **8**: 132, 1902. This species was described from Japan on an unidentified host. No material has been seen but the description does not suggest *Dermea.*

D. Eucalypti Cke. & Hark. Grev. **9**: 130, 1881. A specimen marked "type" was kindly loaned from the Herbarium of the California Academy of Science. It was scanty and in poor condition and it was not possible to place the fungus satisfactorily from this material. It did not appear to be a *Dermea.*

D. eucrita (Karst.) Rehm, Rab. Krypt.-Fl. I, **3**: 255, 1889 = *Pezicula eucrita* Karst. Monogr. Pez. Fenn. p. 147, 1869. This is probably a synonym of *P. livida* (Berk. & Br.) Rehm, Ber. Naturh. Ver. Augsburg **26**: 112, 1881.

D. Fagi Phill. Grev. **15**: 114, 1887 = *Pezicula Fagi* Boud. Disc. d'Eur. p. 159, 1907.

D. fascicularis Fries, Summ. Veg. Scand. p. 362, 1849 = *Encoelia fascicularis* Karst. Myc. Fenn. **1**: 217, 1871.

D. ferruginea (Cke. & Ell.) Rehm, Ann. Myc. **2**: 353, 1904. Type material of this species in the Farlow Herbarium has been seen, but it was very scanty and in poor condition. The host is not identified. It appeared to be a *Pezicula,* or at least closer to that genus than to *Dermea.*

D. ficicola Pat. Journ. de Bot. **11**: 346, 1897. This species is known to me only from the description in Saccardo, Syll. Fung. **14**: 795, 1899, and it cannot be satisfactorily placed. It is doubtful that it belongs in this genus. It is said to occur on *Ficus.*

D. fissa Fries, Summ. Veg. Scand. p. 362, 1849. No material of this species has been seen. It is said to occur on *Corylus* and may be an *Encoelia.*

D. flavocinerea Phillips, Grev. **7**: 23, 1878. It was described as occurring on chips of wood. No material has been seen but from the description it would be excluded from *Dermea.*

D. Frangulae (Pers.) Tul. Sel. Fung. Carp. **3**: 161, 1865 = *Pezicula Frangulae* Fuckel, Symb. Myc. p. 279, 1870.

D. fumosa Cke. & Phill. Grev. **8**: 64, 1879. It was described as occurring on rotten wood in New Zealand. No material has been seen and the description does not suggest *Dermea.*

D. furfuracea (Roth) Fries, Summ. Veg. Scand. p. 362, 1849 = *Encoelia furfuracea* Karst. Myc. Fenn. **1**: 218, 1871.

D. fusispora Ell. & Ev. Proc. Acad. N. S. Philad. **45**: 148, 1893. This species was discussed under *D. molliuscula.* It is a synonym of *Pezicula citrinella* Rehm, Ber. Bayer. Bot. Ges. **13**: 199, 1912, but it is not a true *Pezicula.* Seaver (**1945**) has placed it in *Godronia* but except for the superficial similarity of the elongated spores it shows no affinities with this genus.

D. heteromera (Mont.) Bres. apud Rick in Broteria Cienc. Nat.

1: 91, 1932 = *Encoelia heteromera* (Mont.) Nannf. Trans. Brit. Myc. Soc. **23**: 239, 1939.

D. Houghtonii Phillips, Grev. **6**: 24, 1877. Specimens of the fungus in Phill. Elv. Brit. *144* and Cooke Fung. Brit. Exs. *660* have been examined. It belongs in *Pezicula* rather than *Dermea* and should be designated **Pezicula Houghtonii** (Phill.) n. comb. It occurs on Portuguese Laurel, *Prunus lusitanica.*

D. inclusa Peck, N. Y. St. Mus. Ann. Rep. **30**: 62, 1878 = *Ocellaria ocellata* (Pers.) Schroet. Krypt.-Fl. Schles. III, **2**: 150, 1908. Part of the type in the Durand Herbarium *6073* has been seen.

D. juniperina Ell. Amer. Nat. **17**: 192, 1883 = *Chloroscypha juniperina* Seaver, Mycologia **23**: 250, 1931.

D. Kalmiae (Peck) Cooke, Disc. U. S. **2**: 23, 1875. Two specimens identified as this species have been seen, a specimen on *Vaccinium* in the Farlow Herbarium and a specimen in Ell. N. Amer. Fung. *147.* In both of these the material was in poor condition and satisfactory mounts could not be obtained. Rehm (Ann. Myc. **2**: 353, 1904) placed it in *Gorgoniceps* after an examination of the specimen in N. Amer. Fung. *147,* but he described the spores as 25–30 × 1 μ whereas the original description gave them as 10 × 5 μ. This would suggest that the Ellis specimen was not correctly identified. It was also on *Vaccinium* whereas the type was said to be on *Kalmia.* The identity of this fungus is in doubt, but the original description suggests a *Velutaria.*

D. laricicola (Fuckel) Rehm, Rab. Krypt.-Fl. I, **3**: 254, 1889 = *Pezicula laricicola* Fuckel, Symb. Myc. p. 279, 1870. This fungus appears to be morphologically indistinguishable from *P. livida* (B. & Br.) Rehm, Ber. Naturh. Ver. Augsburg **26**: 112, 1881.

D. lilacina (Bres.) Rehm, Rab. Krypt.-Fl. I, **3**: 1255, 1896. It was described as occurring on *Alnus.* No material has been seen but the description does not suggest *Dermea.*

D. livida (B. & Br.) Phill. Man. Brit. Disc. p. 340, 1893 = *Pezicula livida* Rehm, Ber. Naturh. Ver. Augsburg **26**: 112, 1881.

D. lobata Ell. Bull. Torrey Club **6**: 108, 1876. Through the kindness of Dr. Seaver it was possible to examine the type and other specimens in the herbarium of the New York Botanical Gar-

den. The type is on *Quercus* but other specimens on *Andromeda* had also been identified as this species by Ellis. All of the material on *Quercus* was immature and no asci or spores could be found. The young apothecia suggested a *Velutaria* or *Encoelia* in general appearance. The specimens on *Andromeda* were in good fruit and were certainly a species of *Velutaria* but, in my opinion, are not the same species as the specimens on *Quercus*. The young apothecia are smaller and less globose than those on *Quercus*, and are a little paler colored. The paraphyses are rounded and enlarged at the tips whereas those of the *Quercus* specimens in the immature material examined appeared to be pointed. In this respect they suggested *Cenangium quercicolum* Romell which has lance-shaped paraphyses. The apothecia of this species, from specimens in Romell Fung. Exs. Scand. *199* and Vestergren Microm. Rar. Sel. *213*, are similar to those of *D. lobata* in gross appearance, but the spores and paraphyses do not agree with Ellis' original description. The North American species on *Quercus* should be re-studied in fresh condition and the characters of the ascospores and paraphyses determined with certainty. If, as seems possible, Ellis' original description was compounded from both the *Quercus* and *Andromeda* specimens, the name must be regarded as a *nomen confusum* and dropped.

D. macrospora Clements, Bull. Torrey Club **30**: 87, 1903 = *Ocellaria ocellata* (Pers.) Schroet. Krypt.-Fl. Schles. III, **2**: 150, 1908.

D. Magnoliae (Berk. & Curt.) Cooke, Grev. **7**: 48, 1878. A specimen in Rav. Fung. Amer. *70* on *Persea* has been examined, and agrees with the original description. The apothecia are like a large *Dermea* in gross appearance, but the asci are like those of an *Ocellaria* and the ascospores are also like those of an *Ocellaria* but are brown. It is not possible to place this species satisfactorily at present but it should be excluded from *Dermea*.

D. microspora Vel. Mon. Disc. Bohem. p. 65, 1934. No material of this species has been seen but it should be compared with the one described as *D. pinicola* in this paper. It was said to occur on *Pinus* and the description suggests *D. pinicola*. If they prove to be identical, Velenovsky's name is valid.

D. micula (Fr.) Rehm, Rab. Krypt.-Fl. I, **3**: 261, 1889. This is an interesting fungus occurring on *Rhamnus*. It has apothecia like a *Pezicula*, but has subfiliform conidia like a *Micropera*, and is similar to *P. alnicola* Groves (Mycologia **32**: 120, 1940) in this respect. This species has been studied in culture and a detailed account will be published later. It should be placed in *Pezicula*.

D. minuta Peck, N. Y. St. Mus. Ann. Rep. **32**: 48, 1879 = *Pezicula minuta* Peck, N. Y. St. Mus. Bull. **2**: 21, 1887. Part of the type in the Durand Herbarium *6075* has been examined.

D. minuta Vel. Mon. Disc. Bohem. p. 63, 1934. This species was described as occurring on *Salix*. No material has been seen but the description does not suggest *Dermea*. The name is invalid as it is a later homonym of *D. minuta* Peck.

D. Mori Peck, N. Y. St. Mus. Bull. **157**: 46, 1912. It has not been possible to see any specimens of this species which was described from Kansas as occurring on *Morus*. It cannot be placed with certainty from the description, but there is nothing to definitely exclude it from *Dermea*.

D. mycophaga Mass. Kew Bull. Misc. Inf. **22**: 218, 1908. It was described as occurring on *Xylaria* in the Straits Settlements. No material has been seen but the description does not suggest *Dermea*.

D. myrtillina Karst. apud Vel. Mon. Disc. Bohem. p. 64, 1934 = *Pezicula myrtillina* Karst. Myc. Fenn. **1**: 165, 1871.

D. nectrioides Phill. Man. Brit. Disc. p. 340, 1893. This species was described as occurring on cones of *Pinus sylvestris*. No material has been seen but it seems close to *D. conigena* Phill.

D. nodulariformis Rea, Trans. Brit. Myc. Soc. **5**: 256, 1916. No material of this fungus has been seen but the description does not suggest *Dermea*. The host was not identified.

D. olivacea Otth, Bern. Mitth. p. 40, 1868. No material has been seen. It was described as occurring on *Prunus* and the description does suggest a *Dermea*, but without specimens it is impossible to decide whether it is a synonym of one of the three species recognized on this host.

D. olivacea Ellis, Bull. Torrey Club **6**: 133, 1876. Through the kindness of Dr. F. J. Seaver it was possible to examine the type

and other specimens identified as this fungus in the Herbarium of the New York Botanical Garden. The type is on *Ilex*, and two other collections on *Ilex* and the specimen in Ellis N. Amer. Fung. *851* agree closely with it. The fungus is not a *Dermea*. It is closer to *Pezicula* and probably belongs among the *Ocellaria*-like species of this genus but should be studied in fresh condition before it is finally placed. A scanty collection on *Andromeda* was also referred to this species, but although it resembled it in gross appearance, the asci were slightly narrower and the ascospores a little longer. Another collection, said to be on "ash?", was also similar in gross appearance but differed quite markedly in the shape of the asci. In addition, a specimen in the Farlow Herbarium on *Vaccinium* also differed from the type in the shape of the asci. I am of the opinion that there is a group of species which have been lumped under this name, but it will be necessary to study them in the fresh condition and in culture before they can be placed satisfactorily. The specific name is invalid as it is a later homonym of *D. olivacea* Otth.

D. olivacea Kirschst. Verh. Bot. Ver. Brandbg. **18**: 40, 1906 = *Dermatella hortorum* Kirschst. Ann. Myc. **34**: 210, 1936. Kirschstein gave this species a new name because he recognized that it was a later homonym of *D. olivacea* Otth. No material has been seen but it should be compared with *Pezicula plantarium* Wollenweber.

D. olivascens Rehm, Ann. Myc. **5**: 80, 1907. From the specimens in Rehm Ascom. *1686* this is a *Pezicula* and is morphologically indistinguishable from *P. crataegicola* (Durand).

D. Ononidis Vel. Mon. Disc. Bohem. p. 64, 1934. No material of this species has been seen but the description does not suggest a *Dermea* and its occurrence on herbaceous plants would seem to exclude it from this genus.

D. pallidula Cke. Grev. **16**: 70, 1888 = *Pezicula pallidula* (Cke.) Rehm, Ber. Bayer. Bot. Ges. **13**: 199, 1912.

D. palmicola Pat. Bull. Soc. Myc. Fr. **28**: 35, 1912. This fungus was described on palms from French Guinea. No material has been seen but the description suggests that it is closer to *Encoelia* than to *Dermea*.

D. parasitica (Wint.) Höhn. Fragm. z. Myk. no. 455, 1909. No material has been seen, but its habitat on leaves of *Melastomataceae* would appear to exclude it from *Dermea*.

D. pelidna Kalchbr. & Cke. Grev. **9**: 25, 1880. This was described from South Africa on an unknown host. No material has been seen but the description suggests that it is closer to *Encoelia* than to *Dermea*.

D. phyllophila Peck, N. Y. St. Mus. Ann. Rep. **31**: 47, 1879. It has not been possible to see authentic material of this fungus, but specimens agreeing with the original description have been studied in the fresh condition and cultured. It occurs on leaves of *Abies* and is probably closer to *Mollisia* than to *Dermea*.

D. Piceae (Pers.) Rehm, Rab. Krypt.-Fl. I, **3**: 257, 1889. It has not been possible to see authentic material, but specimens on leaves of *Abies grandis* which agree closely with Rehm's description were received from Dr. John Ehrlich. The fungus is not a *Dermea* but cannot be satisfactorily placed at present.

D. Pini Otth, Bern. Mittheil. p. 40, 1868. This was described as occurring on *Picea excelsa*. It is known to me only through the description in Saccardo Syll. Fung. **14**: 795, 1899. The description is incomplete but it does suggest a true *Dermea* species.

D. Pini Phill. & Hark. Grev. **13**: 22, 1884 = *Cenangium ferruginosum* Fr. Syst. Myc. **2**: 187, 1822. Through the kindness of the California Academy of Science it was possible to examine the type of this species.

D. polygonia (Fckl.) Rehm, Rab. Krypt.–Fl. I, **3**: 263, 1889. It was originally described as occurring on *Pyrus Malus*. In the original description Fuckel stated that the asci were many-spored suggesting *Tympanis,* but the specimen in Fuckel Fung. Rhen. *2677* has eight spored asci. However, it is not a *Dermea*. The identity of this fungus is obscure. Saccardo (Syll. Fung. **8**: 556 and 579, 1889) took the view that Fuckel had two fungi. He made the combination *Tympanis polygonia* for the fungus described by Fuckel and retained the name *Cenangium polygonium* for the fungus in the exsiccatus. Study of fresh material is essential before the species can be satisfactorily placed.

D. populina Schw. In Kelsey, Journ. Myc. **5**: 82, 1889. This

name appeared in a list of fungi of Helena, Montana. Schweinitz does not appear to have made such a combination and it is not clear whether it was intended to designate the following species or *Cenangium populinum* Schw. Syn. p. 239, 1832. The name has no standing.

D. populnea Schw. Syn. Fung. Amer. Bor. p. 237, 1832. Through the kindness of Mr. J. A. Stevenson it was possible to examine part of the type of this species. It is not a discomycete. The material was not in good condition but appeared to be fruiting bodies of a pyrenomycete. The name should be dropped. Saccardo, Syll. Fung. **8**: 576, 1889, wished to place this species in *Cenangium* and in order to avoid creating a homonym of *C. populneum* Pers. he gave it a new name, *C. Schweinitzii*. This name, also, should be dropped.

D. pruinosa (Farl.) Petr. Ann. Myc. **20**: 196, 1922 = *Pezicula pruinosa* Farl. Mycologia **14**: 102, 1922.

D. Pseudoplatani Phill. Grev. **17**: 45, 1888. This fungus is unquestionably a *Pezicula* and appears to be very close to or perhaps identical with *P. carnea* (Cke. & Ell.) Rehm, Ber. Bayer. Bot. Ges. **13**: 199, 1912.

D. puberula Durand, Journ. Myc. **10**: 101, 1904. Through the kindness of Professor H. M. Fitzpatrick the type of this fungus has been examined. It is not a *Dermea* but cannot be satisfactorily placed at present.

D. pulcherrima Fckl. Symb. Myc. Nachtr. **2**: 56, 1873. No material has been seen, but it seems probable that the name was based on unusually large apothecia of *D. Cerasi*.

D. pulchra Starb. Arkiv. f. Bot. **2**: 6, 1904. This was described on an unknown host from Brazil. From the description it appears to be closer to *Encoelia* than to *Dermea*.

D. pulveracea (A. & S.) Rehm, Ber. Bayer. Bot. Ges. **13**: 197, 1912. The concept of this species is very much confused. It is evident from the literature that various fungi on different hosts have passed under this name. No authentic material has been seen and it is impossible at present to say what it may be. It was originally described as occurring on *Betula*. The original description is slightly suggestive of a *Tympanis*, but the figure might be a *Ciboria*.

D. purpurascens Ell. & Ev. Journ. Myc. **4**: 100, 1888 = *Pezicula purpurascens* Seaver, Mycologia **37**: 414, 1942.

D. purpurea (Hedw.) Fr. Summ. Veg. Scand. p. 362, 1849. This species is known to me only through the description in Saccardo Syll. Fung. **8**: 568, 1889. This does not suggest a *Dermea* but it is not possible to say what the fungus might be.

D. purpurea Ell. Bull. Torrey Club **6**: 108, 1876 = *D. viburnicola* Ell. N. Amer. Fung. *397*, 1879. The name was a later homonym of *D. purpurea* (Hedw.) Fr. and was changed by Ellis on the specimen issued in N. Amer. Fung. It was later changed again by Saccardo in Syll. Fung. **8**: 566, 1889 to *Cenangium Ellisii*. The species belongs in *Encoelia*.

D. quercina (Fckl.) Rehm, Rab. Krypt.-Fl. I, **3**: 1257, 1896 = *Pezicula quercina* Fckl. Symb. Myc. p. 279, 1870.

D. radulicola Fuckel, Symb. Myc. p. 278, 1870. Nannfeldt in Trans. Brit. Myc. Soc. **20**: 204, 1936, stated that the type of *Peziza Johnstoni* Berk. was the same as this species and Berkeley's name is the earlier. The fungus appears to be an *Encoelia* judging from specimens in Fckl. Fung. Rhen. *2073*, Rehm Ascom. *1902*, and a specimen *ex* Herb. Barbey-Boissier *1127*.

D. rhabarbarina (Berk.) Phill. Man. Brit. Disc. p. 343, 1893 = *Pezicula rhabarbarina* Tul. Sel. Fung. Carp. **3**: 183, 1865.

D. Rhododendri Rehm, Ber. Naturh. Ver. Augsburg **26**: 29, 1881. This is apparently a *Velutaria* that Rehm later stated to be identical with *D. Cenangium* (Ces.) DeNot. It is not the same fungus as *Velutaria Rhododendri* (Ces.) Rehm (which is not a true *Velutaria*).

D. rhododendricola Rehm, Rab. Krypt.-Fl. I, **3**: 254, 1889 = *Pezicula rhododendricola* Rehm, Ber. Bayer. Bot. Ges. **13**: 200, 1912.

D. Rickiana Rehm, Ann. Myc. **6**: 319, 1908. No material of this species, which was described from Brazil, has been seen but the description does not suggest a *Dermea*.

D. Rosae Rehm, Rab. Krypt.-Fl. I, **3**: 259, 1889 = *Pezicula Rosae* Sacc. Mich. **1**: 59, 1877.

D. rosella Rehm, Rab. Krypt.-Fl. I, **3**: 257, 1889 = *Pezicula citrinella* Rehm. See discussion of *D. fusispora* Ell. & Ev.

D. Rubi (Lib.) Rehm, Rab. Krypt.-Fl. I, **3**: 258, 1889 = *Pezicula Rubi* (Lib.) Niessl, Rab. Fung. Eur. *2122*, 1876.

D. rubiginosa Fr. Summ. Veg. Scand. p. 362, 1849. This fungus is known to me only through the description in Saccardo Syll. Fung. **8**: 569, 1889. It was described from Russia, and was said to be on rotten wood. The description does not suggest *Dermea*.

D. rufa Cooke, Grev. **8**: 72, 1879. This species was described as occurring on bark in Natal, Africa. No specimen has been seen, but the description does not suggest *Dermea*.

D. Sabalidis Ell. & Mart. Amer. Nat. **18**: 1147, 1884. No specimen of this species has been seen, but the habitat and the small asci and ascospores make it improbable that it belongs in *Dermea*.

D. seriata (Fr.) Tul. Sel. Fung. Carp. **3**: 160, 1865 = *Scleroderris seriata* (Fr.) Rehm, Rab. Krypt.-Fl. I, **3**: 211, 1889.

D. simillima Ell. & Ev. Proc. Acad. Nat. Sci. Philad. **1893**: 451, 1894 = *Pezicula carnea* (Cke. & Ell.) Rehm, Ber. Bayer. Bot. Ges. **13**: 199, 1912.

D. sparsa P. Henn. Hedw. **41**: 19, 1902. This species was described on leaves of palms from Brazil. No material has been seen but the description does not suggest *Dermea*.

D. Spiraeae Schw. Syn. Fung. Amer. Bor. p. 237, 1832. Through the kindness of Mr. J. A. Stevenson it was possible to examine the type. The specimen was very scanty and contained only some old fruiting bodies which might be either pycnidia or perithecia. The fungus is certainly not a discomycete and the name should be dropped.

D. stegioides Speg. Mich. **1**: 471, 1879. This species was described as occurring on *Quercus sessiliflora* in Italy. No material has been seen but the description does not suggest *Dermea*.

D. Sydowii Rehm, in Syd. Myc. March. *379*, 1882. The type, which was found on *Lupinus luteus*, has been examined. It is closer to *Encoelia* than to *Dermea*, but should be studied further.

D. Syringae Rehm, Asc. Lojk. p. 20, 1873. This fungus was described as occurring on *Syringa vulgaris* in Hungary. No material has been seen but the description does not suggest *Dermea*.

D. tabacina Cooke, Bull. Buff. Soc. Nat. Sci. **3**: 24, 1875 = *Dermateopsis tabacina* Nannf. Nova Acta Reg. Soc. Sci. Upsal. IV, **8**: 89, 1932.

D. tetraspora Ell. Bull. Torrey Club **6**: 108, 1876. Authentic specimens of this species in the Farlow Herbarium have been examined. The apothecia suggest *Velutaria,* but it is remarkable for the large four-spored asci and very large almost globose spores. It is not a *Dermea,* but should be studied further.

D. tijucensis P. Henn. Hedw. **43**: 91, 1904. This species was described as occurring on *Tijuca* in Brazil. No material has been seen but the description does not suggest a *Dermea.*

D. tiliacea Fr. Summ. Veg. Scand. p. 362, 1849 = *Encoelia tiliacea* Karst. Myc. Fenn. **1**: 218, 1871.

D. turicensis (Rehm) Vel. Mon. Disc. Bohem. p. 63, 1934. No material has been seen but the description and figures of Velenovsky do not suggest *Dermea.* It has been reported on *Juniperus, Picea,* and *Corylus* so probably more than one fungus has been confused under this name.

D. Ulicis Cooke, Grev. **3**: 186, 1875. This was described as occurring on *Ulex* in England. No material has been seen but the description suggests *Encoelia,* and Nannfeldt, who examined the type, stated in Trans. Brit. Myc. Soc. **23**: 249, 1939 that it belonged in this genus.

D. Ulmi (Tul.) Fckl. Symb. Myc. Nachtr. **2**: 56, 1873 = *Encoelia siparia* (B. & Br.) Nannf. Trans. Brit. Myc. Soc. **20**: 196, 1936.

D. umbrina Cke. & Mass. Grev. **21**: 72, 1893. This species was described as occurring on *Ulex* in England. No material has been seen but the description suggests *Encoelia* rather than *Dermea.*

D. vernicosa (Fckl.) Rehm, Rab. Krypt.-Fl. I, **3**: 262, 1889. This species was discussed under *D. Cerasi.* Its identity is not known.

D. versiformis (Alb. & Schw.) Rehm, Ber. Bayer. Bot. Ges. **13**: 197, 1912 = *Pezicula Frangulae* (Pers.) Fckl. Symb. Myc. p. 279, 1870. This name was based on the conidial stage of *P. Frangulae.*

D. viburnicola Ell. N. Amer. Fung. *397,* 1879. This was discussed under *D. purpurea* Ell.

D. viridis Vel. Mon. Disc. Bohem. p. 399, 1934. This fungus was described as occurring on *Quercus.* No material has been seen but the description does not suggest *Dermea.*

D. Xanthoxyli [illegible], N. Y. St. Mus. Ann. Rep. **31**: 47, 1879.

Through the kindness of Professor H. M. Fitzpatrick it was possible to examine part of the type of this species in the Durand Herbarium. The apothecia were growing on the stroma of *Thyronectria pyrrhochlora* (Auersw.) Sacc. No asci or spores were found in this material but the fungus is not a *Dermea*.

ACKNOWLEDGMENTS

In presenting this paper I wish to tender my sincere thanks to the following, without whose invaluable assistance and friendly co-operation these studies would not have been possible. I am especially indebted to Professor H. S. Jackson for his continued interest and helpful criticisms and suggestions throughout the course of the work and in the preparation of the manuscript. Dr. D. H. Linder has made available the specimens in the Farlow Herbarium and Professor H. M. Fitzpatrick many specimens in the Durand Herbarium; Dr. F. J. Seaver and Mr. J. A. Stevenson have loaned type and authentic specimens. Collections of fresh and dried material have been received from many mycologists including Dr. L. O. Overholts, Dr. L. E. Wehmeyer, Dr. W. L. White, Dr. G. D. Darker, Miss E. K. Cash, Mr. H. E. Parks, Dr. S. M. Pady, and Dr. R. F. Cain. Constructive criticism and other assistance in preparation of the manuscript have been received from Dr. F. L. Drayton, Mr. I. L. Conners, and Dr. A. J. Skolko. Dr. D. P. Rogers has given helpful advice with some of the nomenclatural problems.

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INDEX TO GENERA AND SPECIES

EXPLANATION OF FIGURES

FIGS. 1–26. Photographs of apothecia and conidial stages of *Dermea* species. M = 4 × approx.

FIG. 1. Apothecia of *D. Cerasi*, JWG *122*; 2. Conidial stage of *D. Cerasi*, JWG *86*; 3. Apothecia of *D. Padi*, JWG *460*; 4. Conidial stage of *D. Padi*, Krieg. Fung. Sax. *2388*; 5. Apothecia of *D. Prunastri*, DAOM *ex* USDA *1402*; 6. Conidial stage of *D. Prunastri*, DAOM *3789*; 7. Apothecia and conidial stage of *D. Libocedri*, JWG *691*; 8. Apothecia of *D. balsamea*, JWG *45*; 9. Conidial stage of *D. balsamea*, JWG *281*; 10. Apothecia of *D. Chionanthi*, Fung. Columb. *2423*; 11. Apothecia of *D. piceina*, JWG *795*; 12. Conidial stage and immature apothecia of *D. piceina*, JWG *788*; 13. Apothecia of *D. Tulasnei*, JWG *403*; 14. Conidial stage of *D. Tulasnei*, JWG *468*; 15. Apothecia of *D. pinicola*, JWG *402*; 16. Apothecia and conidial stage of *D. acerina*, DAOM *5310*; 17. Apothecia of *D. Hamamelidis*, type of *Dermatella Hamamelidis* Ell. & Ev. *ex* F; 18. Apothecia of *D. Peckiana*, JWG *428*; 19. Conidial stage of *D. bicolor*, DAOM *7935*; 20. Apothecia of *D. bicolor*, JWG *725*; 21. Apothecia and conidial stage of *D. molliuscula*, DAOM *5317*; 22. Apothecia of *D. Ariae*, JWG *406*; 23. Conidial stage of *D. Ariae*, JWG *406*; 24. Apothecia and conidial stage of *D. Viburni*, DAOM *7937*; 25. Conidial stage of *D. Hamamelidis*, JWG *162*; 26. Conidial stage of *D. Peckiana*, DAOM *3781*.

FIGS. 27–41. Photographs of freehand sections of conidial fruiting bodies of *Dermea* species. M = 52 × approx.

FIG. 27. *D. Cerasi*, JWG *28*; 28. *D. Prunastri*, DAOM *4713*; 29. *D. Padi*, JWG *460*; 30. *D. balsamea*, JWG *10*; 31. *D. Libocedri*, JWG *691*; 32. *D. piceina*, JWG *788*; 33. *D. bicolor*, JWG *715*; 34. *D. Ariae*, JWG *180*; 35. *D. Peckiana*, DAOM *3781*; 36. *D. acerina*, JWG *134*; 37. *D. Tulasnei*, JWG *305*; 38. *D. Viburni*, JWG *230*; 39. *D. molliuscula*, JWG *278*; 40. *D. Chionanthi*, JWG *748*; 41. *D. Hamamelidis*, JWG *162*.

FIGS. 42–57. Drawings of asci, ascospores, conidia, and microconidia of *Dermea* species.

FIG. 42. *D. Cerasi*—*a*, asci and ascospores—*b*, conidia and microconidia; 43. *D. Prunastri*—*a*, asci and ascospores—*b*, conidia and microconidia; 44. *D. Padi*—*a*, asci and ascospores—*b*, conidia and microconidia; 45. *D. bicolor*—*a*, asci and ascospores—*b*, conidia and microconidia; 46. *D. Hamamelidis*—*a*, asci and ascospores—*b*, conidia; 47. *D. molliuscula*—*a*, asci and ascospores—*b*, conidia and microconidia; 48. *D. Chionanthi*—*a*, asci and ascospores—*b*, conidia; 49. *D. Viburni*—*a*, asci and ascospores—*b*, conidia and microconidia; 50. *D. acerina*—*a*, asci and ascospores—*b*, conidia and microconidia; 51. *D. pinicola*—*a*, asci and ascospores—*b*, conidia; 52. *D. piceina*—*a*, asci and ascospores—*b*, conidia; 53. *D. Ariae*—*a*, asci and ascospores—*b*, conidia and microconidia; 54. *D. balsamea*—*a*, asci and ascospores—*b*, conidia and microconidia; 55. *D. Tulasnei*—*a*, asci and ascospores—*b*, conidia and microconidia; 56. *D. Peckiana*—*a*, asci and ascospores—*b*, conidia and microconidia; 57. *D. Libocedri*—*a*, asci and ascospores—*b*, conidia.

CHROMOBLASTOMYCOSIS. SOME OBSERVATIONS ON THE TYPES OF THE DISEASE IN SOUTH AFRICA

F. W. Simson [1]

In 1943 a report on six cases of chromoblastomycosis occurring in the Union of South Africa was published by Simson, Harington and Barnetson (1) and among these cases the causal fungus was isolated in two instances. Since that date six additional cases of the disease have been diagnosed by the writer and from lesions in four of them the organisms have been recovered and classified.

Among all twelve cases diagnosed to date, including those published in 1943, eleven showed lesions which were primarily confined to a lower limb. In the remaining case the disease affected the skin in the region of the anus. Ten of the subjects affected were Africans and two were Europeans.

Unfortunately no opportunity was afforded for cultivating the organism from lesions in four of the first series or from two in the second series of cases.

An analysis of the clinical pictures presented by these twelve cases of chromoblastomycosis shows that the lesions manifested themselves as two distinct types. In the first they were more or less solitary and in the second they were multiple, diffusely disseminated over the greater part of a limb and in some parts showed a tendency to become confluent, particularly in the old standing parts of the condition. The general character of the pathological process is the same. It presents the appearance of warty growths, which are distinctly friable to the touch, superficially involving the skin and to a slight extent some of the deeper connective tissue and fat underlying the infected area of the skin. In no case was there any suggestion of sinus formation, and no

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FIG. 1. Chromoblastomycosis.

involvement of deeper structures, such as muscle and bone, was ever observed.

Histologically, the inflammatory condition, which results from the presence of the fungus, is basically a reticulo-endotheliosis. In a section of infected skin and subjacent subcutaneous tissue, there is irregularity and warty thickening of the squamous epithelium with some degree of hyperkeratosis. The rete pegs are hypertrophied and elongated and are often found to extend deeply into the corium. The corium is much thickened by the inflammatory process, the background of which consists of infiltrating plasma cells, small round lymphocyte-like cells, eosinophiles and connective tissue elements. The characteristic part of the inflammation, however, consists of two kinds of follicle formation. These follicles are embedded in the background of non-specific inflammatory tissue. One follicle, which is found more commonly in the very chronic lesions, is composed almost wholly of reticulo-endothelial cells, sometimes with a centrally placed multinucleated giant cell of the Langhans' type. These giant cells may or may not contain one or more brownish colored "sclerotic bodies"—the characteristic tissue form of the fungus. The second type of follicle consists of a central area of neutrophil polynuclear leucocytes surrounded by an outer zone of reticulo-endothelial cells. Sclerotic bodies may also be found in these follicles. The follicles of the very chronic lesions often closely simulate the appearance of tuberculosis, but absence of tubercle bacilli and the presence of sclerotic bodies should eliminate any possibility of confusion with this disease.

The sclerotic body or tissue form of the fungus is quite distinctive. It is rounded, brown or yellowish brown in color and measures, as a rule, 6–10 μ in diameter. It shows no significant variation in structure, no matter in what type of clinical manifestation of chromoblastomycosis it may be found. This seems to be important when considering the fact that so many varieties of the vegetative form of the fungus have been recovered from chromoblastomycotic lesions in which these bodies have been demonstrated.

From this it will be gathered that the variety of the fungus subsequently to be isolated cannot be predicted either by the char-

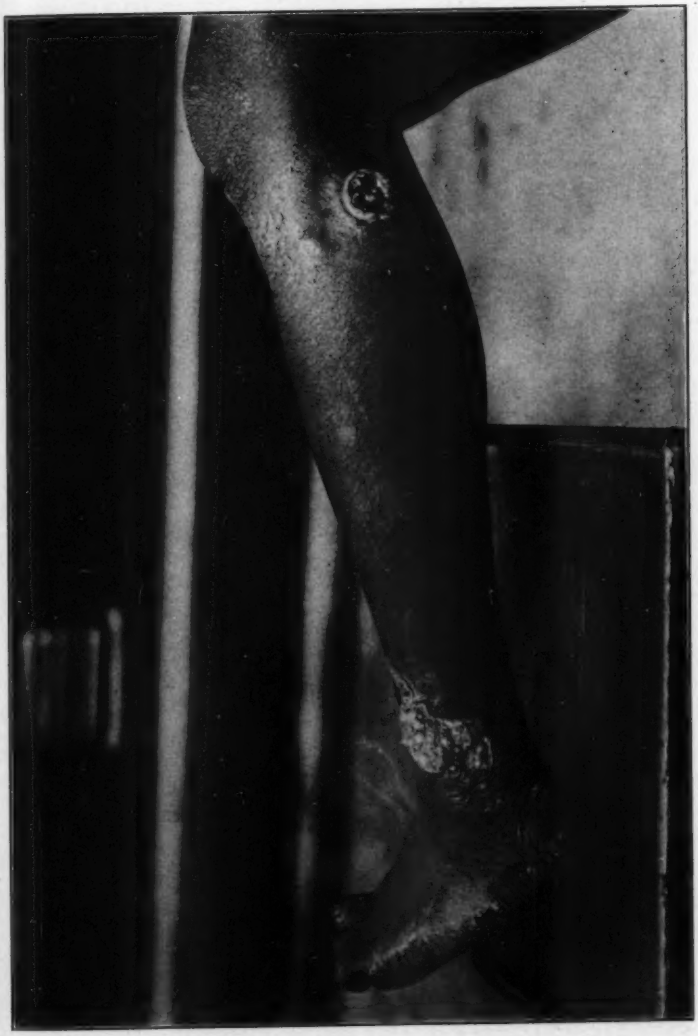

FIG. 2. Chromoblastomycosis.

acter of the tissue change or by the appearance of the sclerotic bodies.

MYCOLOGY

As fungi, recovered from different cases of chromoblastomycosis, may show respectively great variation in their morphology, it is convenient at this point briefly to discuss the classification of the organism.

Among the group of fungi responsible for the lesions of chromoblastomycosis, three methods of sporulation may be found and because only one or sometimes two may be present in a given culture, much confusion in the classification has resulted.

A. L. Carrión (2) has suggested the adoption of a classification which would seem to eliminate most of the confusing issues. In this classification he states ". . . In *Fonsecaea Pedrosoi,* the variety *communis,* which possesses the three types of sporulation—*Cladosporium, Phialophora* and *Acrotheca,*—appears to be the common origin of all other forms. The varieties *Cladosporioides, typicus* and *Phialophorica* show, respectively, a marked predominance of the *Cladosporium, Acrotheca* or *Phialophora* sporulations with a corresponding reduction, in each case, of the other two methods of reproduction. In the species *Phialophora verrucosa* and in the *Hormodendrum* isolate from Venezuela . . . , the *Phialophora* and the *Cladosporium,* respectively, have become the exclusive methods of reproduction."

Carrión (2) also suggests the presumptive existence of other parasites sporulating exclusively by the *Acrotheca* method and that the specimen described as *Botrytoides monospora* by Moore and Almeida comes very close to fulfilling this condition.

The fungus described by Simson, Harington and Barnetson (1) as a pathogenic *Hormodendrum* awaiting classification (FIG. 5) was sent to Dr. A. L. Carrión for favor of his opinion. In a personal communication to the author Dr. Carrión expressed the opinion that this organism is a *Hormodendrum* species closely similar to J. A. O'Daly's isolate from the Venezuelan case.

Of the six South African isolates mentioned previously, two described by Simson, Harington and Barnetson (1) and four recent isolates by the writer, three have been classified as examples

FIG. 3. Chromoblastomycosis.

FIG. 4. Chromoblastomycosis.

of *Fonsecaea Pedrosoi typicus* and three as *Hormodendrum* species similar to J. A. O'Daly's case.

In the three isolates diagnosed as *Fonsecaea Pedrosoi typicus* the *Acrotheca* method of sporulation predominates, the *Cladosporium* form of reproduction is rare and no *Phialophora* cups have as yet been found.

In the second group of three cases the cultural characters of the fungi show no variation and only one method of sporulation is represented, namely the *Cladosporium* or *Hormodendrum* form of reproduction. Cultures have been made on many varieties of medium but no other form of sporulation has been induced. In each instance these three fungi show colonies consisting of a long septate branching mycelium with hyphae averaging 2.5 μ in diameter and possessing terminal and laterally branching conidiophores. The conidia are produced acrogenously in arborescent chains on these terminal and lateral conidiophores. The color of the mycelium is light olive green shading to deeper olive green in the conidiophores. The microscopic appearance is shown respectively in FIGS. 5, 7 and 9.

Carrión (2) has suggested that as a result of his experience the species of the fungus causing the infection does not have much influence on the clinical picture. Among the South African cases on the other hand there is evidence to suggest that the clinical picture may be altered by the species of fungus.

Two outstandingly different varieties of clinical lesion have been noted among the twelve cases recorded here but as in six of them no organism was isolated the variety of the fungus was not identified. Of the remaining six cases which were examined clinically, and from lesions in each of which the fungus was recovered, three showed two or three solitary widely separated lesions (FIGS. 1, 2 and 3). FIGS. 2 and 3 illustrate cases in which there was a cauliflower-like growth in the region of the ankle and a smaller secondary growth situated just below the knee on the same side. In the third case (FIG. 1) a large cauliflower-like growth almost surrounded the ankle and two smaller tumors were present on the upper and posterior aspect of the thigh of the same limb. The organisms isolated from these three cases showed the cultural characteristics of *Fonsecaea Pedrosoi typicus.*

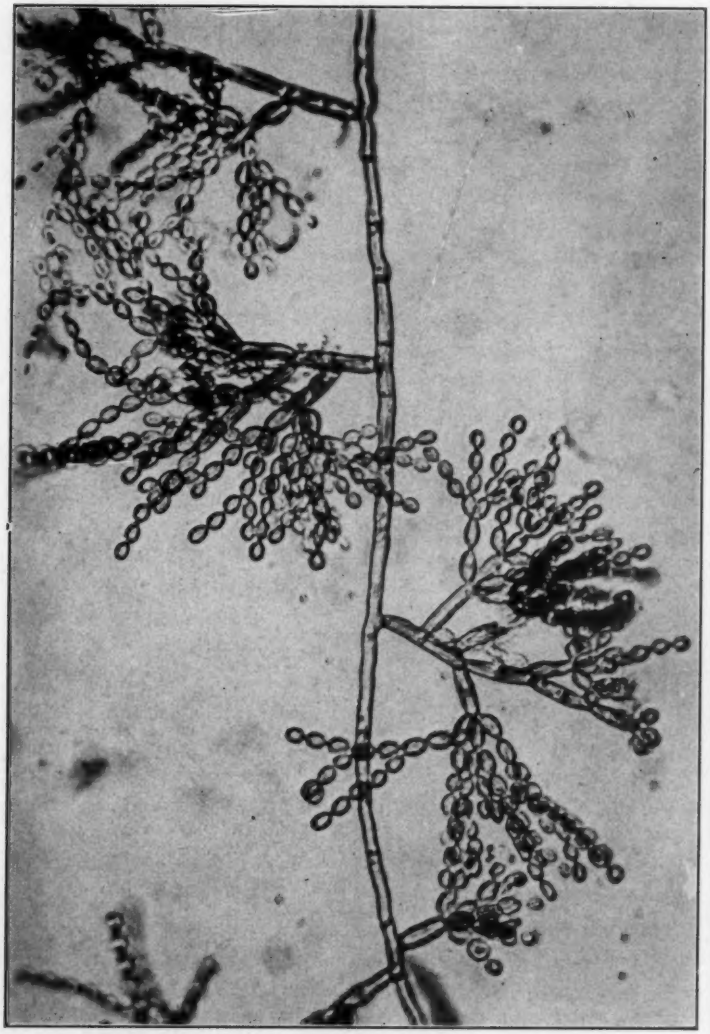

FIG. 5. *F. Pedrosoi* var. *Cladosporium*.

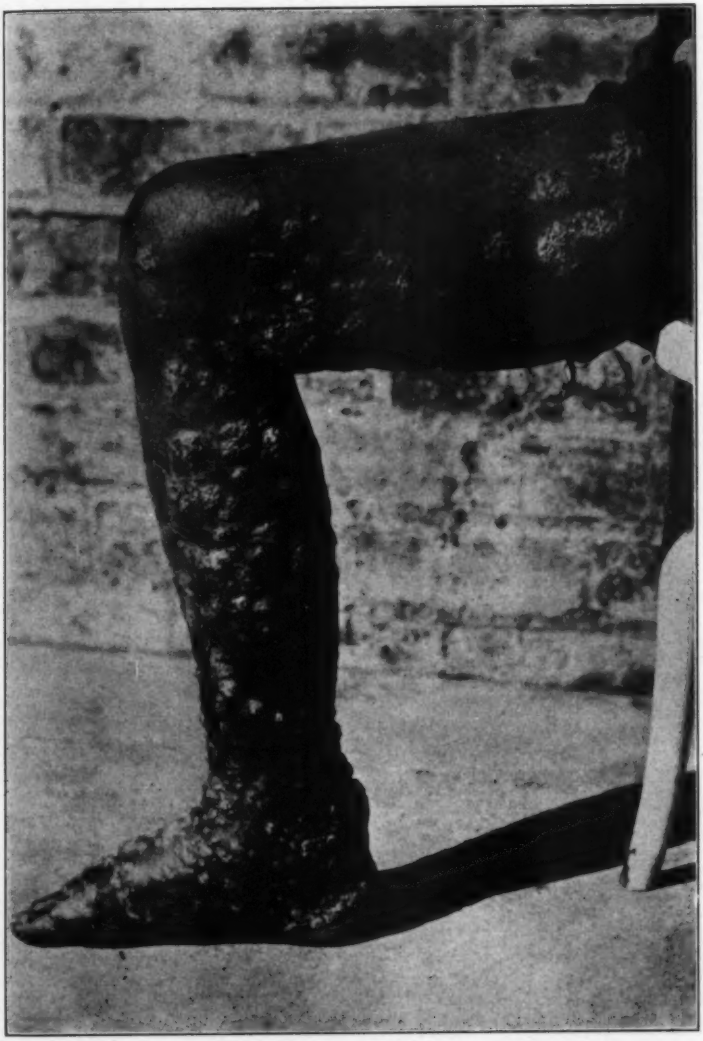

FIG. 6. Chromoblastomycosis.

Multiple lesions were characteristic of the condition in the second group of three cases (FIGS. 4, 6 and 8). They affected the greater part of one lower limb and the fungus recovered from each of these showed the cultural characters of *Fonsecaea Pedrosoi* var. *Cladosporium* (FIGS. 5, 7 and 9). This series of cases is admittedly small but the finding of a specific organism in a specific type of lesion is consistent and therefore suggestive.

It might be objected that the diffuse lesions are a late manifestation of the disease and that the solitary lesions if given sufficient time might progress to such an extent that the limb becomes diffusely involved. This, however, would seem to be unlikely since some solitary lesions have a long history. The case illustrated in FIG. 1 for instance gives a history of having started ten to fifteen years before the date of isolation of the causal fungus and the diagnosis of the disease. The spread of the condition from the primary site of the infection appears to differ in the two types of clinical lesion. In the solitary type it is probably the result of inoculation by scratching because of the distance between primary and secondary growths. In the diffuse type, on the other hand, spread appears to be by superficial lymphatics.

TREATMENT

So far no drug has been found which will cure the disease. The only methods of treatment attended with success are surgical removal, either locally or by amputation of the part, and electrotherapy. The type of lesion, therefore, whether local or diffuse is of great importance in the treatment. Some of the solitary lesions in our series of cases have been treated successfully by local excision and two of the cases with diffuse lesions have been treated by amputation. One was followed by recurrence of the disease in the stump and on the hand of the opposite side. The fate of the second case is not known.

Treatment by freezing of the part was suggested as a means of curing the condition in one of this series of cases—a European male with multiple lesions covering the leg and lower half of the thigh of the right limb (FIG. 8). Before attempting the treatment on the living subject, however, it was thought advisable to carry

FIG. 7. *F. Pedrosoi* var. *Cladosporium.*

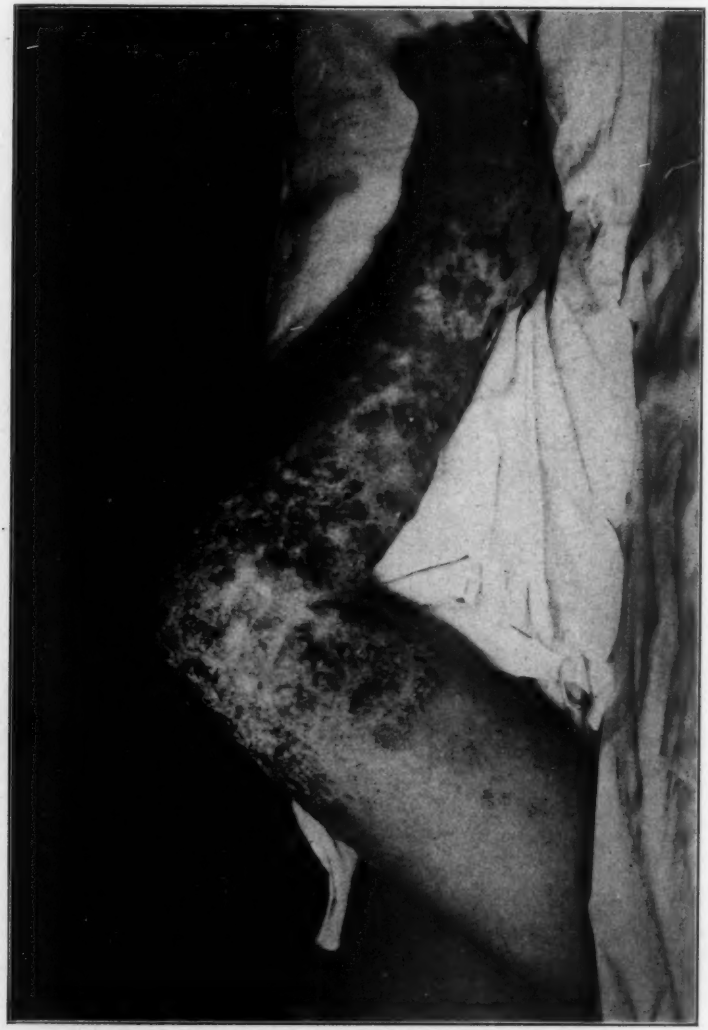

FIG. 8. Chromoblastomycosis.

out an *in vitro* experiment. For this purpose a large papillomatous mass was removed by excision. This piece of tissue was divided into six more or less equal and representative parts and each part was given an identification letter *a* to *f*. Specimen (*a*) was prepared for section and on examination showed the typical histological picture of chromoblastomycosis and in the granulation tissue the characteristic sclerotic bodies were identified.

Specimen marked (*b*) was used as a control and without being treated by freezing was ground up very finely in a mortar and plated out in a Petri dish on Sabouraud's glucose agar medium.

Specimens (*c*), (*d*), (*e*), and (*f*) were transferred to fresh sterile bottles which were placed in a refrigerator and kept at a constant temperature of 0° Centigrade.

Specimen (*c*) was finely ground up in a mortar under sterile conditions and plated out on Sabouraud's medium after a period of freezing for 21 hours.

Specimen (*d*) was prepared in the same manner and plated out after a period of freezing for 72 hours, specimen (*e*) after freezing for 168 hours and specimen (*f*) after freezing for 336 hours. All plates of the series after inoculation were incubated at room temperature (about 22° C.).

Numerous colonies of a pathogenic fungus identified microscopically as *Fonsecaea Pedrosoi* var. *Cladosporium* appeared after the fourth day of incubation on each of the plates marked (*b*), (*c*), and (*d*), representing growth on the control plate and on plates sown with tissue forms of the fungus which had been frozen respectively for 21 hours and 72 hours. FIG. 10 is a photograph of plate (*d*) and shows the appearance of the dark colonies of the fungus three weeks after planting. The colonies were still viable after two months' incubation at room temperature.

Plates (*e*) and (*f*), cultures of organisms frozen respectively for 7 and 14 days, showed viable colonies of the fungus but much fewer in number than appeared on plates (*b*), (*c*), and (*d*). Later, for some unknown reason, although there was at first undoubted evidence of viability of some of the sclerotic bodies, all colonies, including some which had reached a stage of sporulation, died out. It was thought that the death of the fungus on these plates might have been due to some autolytic change in the frozen granu-

FIG. 8. Chromoblastomycosis.

FIG. 9. *F. Pedrosoi* var. *Cladosporium*.

FIG. 10. *F. Pedrosoi* var. *Cladosporium*.

lation tissue with which the sclerotic bodies were mixed at the time of spreading the plates. Evidence that the colonies were viable for a time on these plates was provided by growth of hyphae and definite signs of sporulation. It was concluded from this experiment that the tissue form of the fungus from this case of chromoblastomycosis continues to be viable after being kept at a constant temperature of 0° C. for as long as 14 days.

Further, it may be deduced from the experiment that reducing the temperature of a living affected tissue to a safe point (10° C. or slightly less) is unlikely to prove of value in the treatment of chromoblastomycosis.

SUMMARY

The purpose of this report is to place on record the isolation of six fungi from cases of chromoblastomycosis occurring in South Africa, three of which have been identified as a rare species *Fonsecaea Pedrosoi* var. *Cladosporium*.

It has been suggested in addition that there is evidence to show that in South Africa two varieties of *Fonsecaea* cause respectively two different types of clinical lesion.

Finally an experiment is recorded which shows that the tissue form of the organism remains viable after being kept at freezing point for 14 days which provides evidence to show that treatment of chromoblastomycotic lesions by lowering the temperature to a safe point is not likely to be effective.

ACKNOWLEDGMENTS

I wish to record my thanks to Dr. A. I. Girdwood of the W. N. L. A. Hospital, Johannesburg, to Dr. J. Daneel of the Rietfontein Hospital and to Dr. J. I. H. Frootko of Krugersdorp Hospital for allowing me access to their cases of chromoblastomycosis and to Mr. F. A. Brandt for the photographic illustrations.

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DESCRIPTION OF FIGURES

FIG. 1. African female adult. Large solitary cauliflower growth almost surrounding left ankle. Contracted 10–15 years prior to examination and isolation of fungus. Causal organism *Fonsecaea Pedrosoi typicus.*

FIG. 2. African male adult. Warty friable growth just above lateral malleolus, left leg. Smaller growth on same leg behind head of fibula. Duration not ascertained. Fungus isolated *Fonsecaea Pedrosoi typicus.*

FIG. 3. African male adult. Warty friable growth situated above left malleolus, left leg. Secondary growth situated just below tuberosity of tibia. Duration not known. Fungus isolated *Fonsecaea Pedrosoi typicus.*

FIG. 4. African male adult. Warty growths disseminated over greater part of right leg. Duration probably many years. Leg amputed. Fungus isolated *Fonsecaea Pedrosoi* var. *Cladosporium.*

FIG. 5. Microscopic appearance of fungus isolated from lesions shown in figure 4. Septate hypha bearing exclusively *Cladosporium* or *Hormodendrum* conidiophores.

FIG. 6. African male adult. Disseminated warty growths covering the leg and part of the thigh of right limb. Duration of condition not known. Fungus isolated *Fonsecaea Pedrosoi* var. *Cladosporium.*

FIG. 7. Microscopic appearance of fungus isolated from lesions shown in figure 6. Septate hyphae bearing exclusively *Cladosporium* conidiophores.

FIG. 8. European male adult (Mongol). Diffuse warty growths covering leg and part of thigh of right limb. In the middle third of leg partial spontaneous healing has occurred. Duration probably more than 15 years. Fungus isolated *Fonsecaea Pedrosoi* var. *Cladosporium.*

FIG. 9. Microscopic appearance of fungus isolated from lesions shown in figure 8. Septate hyphae bearing exclusively *Cladosporium* conidiophores.

FIG. 10. Plate showing black colonies of *Fonsecaea Pedrosoi* var. *Cladosporium.* Three weeks growth after cultivation of tissue forms of the fungus following freezing for 72 hours.

ELSINOË PIRI IN FRANCE AND SPAIN IN THE LIGHT OF QUARANTINE INTERCEPTIONS

ANNA E. JENKINS

(WITH ONE FIGURE)

Fresh apple fruits infected by *Elsinoë piri* have previously been intercepted in transit from Ireland, Italy, Switzerland, and Hungary, by port inspectors of the U. S. Bureau of Entomology and Plant Quarantine (**3**: 689). Two additional interceptions of this pathogen on apple fruit, also in transit from Europe, are here recorded.

The more recent of the two is from Spain, and was taken at Galveston, Texas, by R. L. Trigg, on October 16, 1945. This consists of two apples on which are a limited number of spots caused by *Elisinoë piri* (FIG. 1, A and B). These are large as compared, for example, with the numerous spots on an apple fruit previously intercepted from Ireland (**3**, FIG. 1). On the apples from Spain the spots are "vinaceous buff" (**6**) at the center surrounded by "dark mineral red," outside of which is a more or less indefinite zone of "terra cotta." The healthy apple skin in the region of the spotting is "citron green." The particular spot shown in FIG. 1, B, *a*, closely resembles that on the "Ortly" apple variety from Washington State, illustrated elsewhere (**4**, FIG. 1, G) at a magnification of 3½ diameters, and here shown in still greater detail (FIG. 1, C). The dark markings on the spot (FIG. 1, C, *a*) are the conidial stage protruding through the ruptured epidermis.

The first and only available record of *Elsinoë piri* from Spain is furnished by *Melanobasidium mali* Maubl. (**5**), which we have shown to be a synonym of *Elsinoë piri* (**3**: 692 and 696).

The two fresh apples from Spain may well be a variety that originated in that country. Except for their slight blush, these fragrant apples resemble the variety "Reinette de Zaccalmaglio," as illustrated in Switzerland by Zschoppe (**11**). In this natural color reproduction, one of the whole fruits shows typical *Elsinoë* infection. The apples from Spain, as well as the "Reinette de Zaccala-

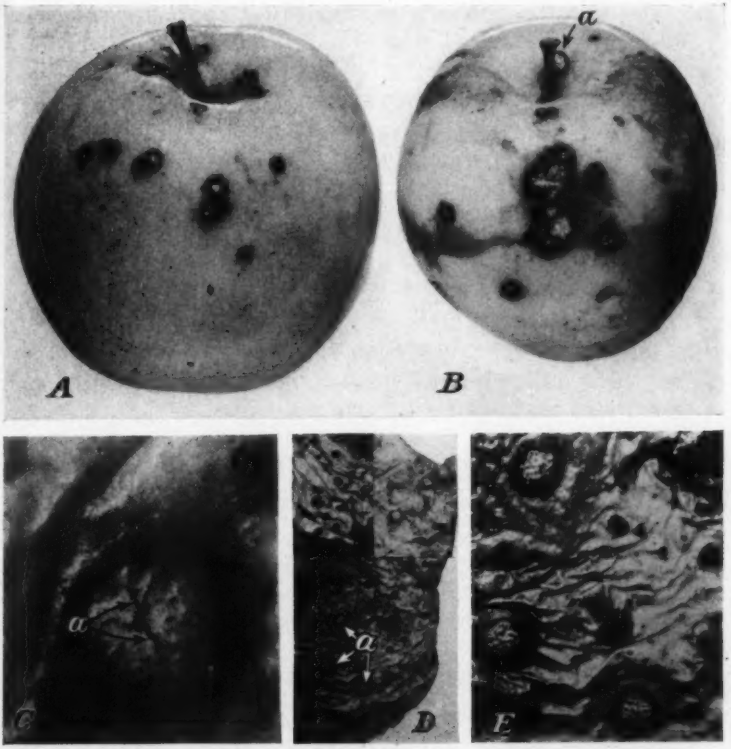

FIG. 1. A and B. *Elsinoë piri* on apples intercepted in transit from Spain. × 1. C. Spot on "Ortly" variety, Bay Center, state of Washington, U. S. A., resembling closely the spot B, *a*, when similarly magnified, *a*, conidial stage. × 12. D. Parts of the interception from France, showing the spots on the dried apple rind. × 1. E. Same as D, *a*, × 3½. Photographs by R. L. Taylor.

maglio," are a different variety from the "Reneta" (sic) (Reineta) from Portugal on which *E. piri* was previously identified (**3**: 698). This is a large flattened-globose red-striped, dessert apple, of which the full varietal name is "Reinette Espriega"; it is widely grown in Portugal and commonly shows the spotting herein described.[1]

[1] This information was furnished by F. M. Villhena, Chief of Services, Department of Agriculture, Lisbon, Portugal, on the occasion of his recent visit to the Plant Industry Station.

The other interception to be reported here is from France and was taken at the port of New York on January 6, 1945. In this case the fungus was identified by W. S. Fields, then referred to the writer for verification. The specimen received consisted of large pieces of dried apple peel on which were numerous spots (FIG. 1, D). On those larger and more mature, the imperfect stage was present in abundance, forming conspicuous light colored pustules (FIG. 1, E). These were covered with a thick, dry crust of hyaline conidia.

At the time that the combination *Elsinoë piri* (Woronich.) Jenkins (**3**: 696) was made, *Hadrotrichum pirinum* (Pegl.) Sacc. (**7**), as well as *Melanobasidium mali*, was shown to be a synonym. Saccardo's combination was made in reporting Hariot No. 12 on pear leaves from Paris (department of Seine-et-Oise), France. Arnaud and Arnaud's (**1**, v. 2: 1059) *Melanobasidium* (?), abundant on pear leaves at Chevreuse, department of Seine-et-Oise, during the rainy seasons of 1930 and 1931, is unquestionably *E. piri*, as apparently is an apple fruit-spot fungus described much earlier by Griffon and Maublanc (**2**: 79–80, FIGS. 3 and 4). For the conidial stage of *E. piri* I have now made (**4**) the combination *Sphaceloma pirinum* from *Gloeosporium pirinum* Pegl.

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A NEW SPECIES OF STAGONOSPORA ON AMBROSIA [1]

D. B. O. Savile [2]

The writer recently had occasion to examine the material in the herbarium of the Division of Botany and Plant Pathology of Seym. & Earle Econ. Fungi 294b. This specimen is labelled *"Cercospora racemosa* Ell. & Martin var. *Ambrosiae* Seym. & Earle and *Entyloma Compositarum* Farl. on *Ambrosia trifida."* The packet contains three pieces of leaf; one bears the red-brown fructifications of the *Cercospora,* which incidentally is not typical of this genus since the spores are largely catenulate; the other two bear the *Entyloma.* The *Entyloma* is a typical example of *E. Compositarum,* but examination of the upper surface of the lesions shows abundant pycnidia of a *Stagonospora.* This fungus appears to be unnamed, and, because of its occurrence in exsiccati material, it seems advisable that it should now be described, despite the fact that only a single specimen has been seen.

Stagonospora Ambrosiae Savile sp. nov. Pycnidia epiphylla 69–107 μ lata × 62–86 μ alta, rotunda, leviter complanata, ostiolis plerumque ellipticis 11–21 × 8–15 μ cingulis nigris, pycnidia raro omnino nigra sed plerumque infra pallida, astromatica; conidia hyalina, 10–33 × (2.2)2.5–3.5 μ, 1–6 plerumque 3–4-septata, recta vel leniter curvata, supra fastigata ad apices rotundatos, inferne truncata subtruncatave.

On lesions of *Entyloma Compositarum* on *Ambrosia trifida,* Valley City, North Dakota, coll. A. B. Seymour; in Seym. & Earle Econ. Fungi 294b in the Mycological Herbarium of the Division of Botany and Plant Pathology, Science Service, Department of Agriculture, Ottawa, Canada.

The conidia illustrated in FIG. 1 have been selected to show the range in size and septation rather than the relative abundance of spores of different forms. In some pycnidia the spores are uni-

[1] Contribution No. 847 from the Division of Botany and Plant Pathology, Science Service, Department of Agriculture, Ottawa, Canada.

[2] Junior Plant Pathologist.

to quadri-, generally tri-septate; in others the septa are frequently four and occasionally five or six.

From the abundance of the fungus in the Ottawa material, it appears probable that it will prove to be present in at least some other packets of this collection.

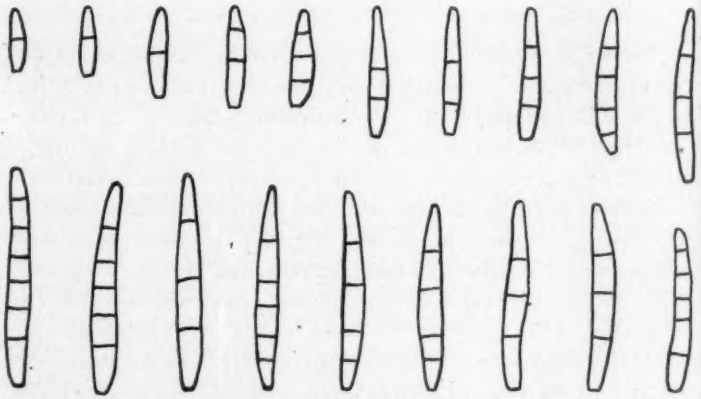

FIG. 1. Conidia of *Stagonospora Ambrosiae* × 1000.

The writer has been unable to find a reference to any *Stagonospora*, or any other genus on *Ambrosia* to which this fungus might reasonably be assigned. He wishes to thank Mr. John A. Stevenson, Bureau of Plant Industry Station, Beltsville, Md., for searching the records of the Bureau for such a fungus.

In this material no pycnidia were seen on the normal leaf tissue, but it is possible that the healthy leaves are occasionally attacked. As will be described in a forthcoming study of *Entyloma* on the Compositae, two specimens have been seen in which *Septoria Lepachydis* is associated with *Entyloma* spp. on *Lepachys columnaris*. In these specimens pycnidia are occasionally found on the normal leaf tissue, and it may be supposed that the *Septoria* is a weak parasite that is well-adapted to attacking tissue already weakened by the smut. The similar habit of *Stagonospora Ambrosiae* suggests that it may have a corresponding rôle.

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CONTROL OF CULTURE MITES BY CIGARETTE PAPER BARRIERS

WILLIAM C. SNYDER AND H. N. HANSEN

(WITH 2 FIGURES)

Workers in mycological and phytopathological laboratories are, unhappily, only too familiar with the several species of mycophagous mites that invade their test tubes and cause serious inconveniences by destroying pure cultures or by contaminating them with other fungi, actinomycetes or bacteria. Some eight years ago when we began a monographic study of the genus *Fusarium* (**13**, **14**) which involved handling and keeping for observation thousands of cultures for periods of several months, we soon realized that the first requirement for effective and dependable work would be to devise some easily applied method by which our cultures could be kept entirely free of mites. In this paper is described a method of mite control which has been in constant use for more than six years and proved to be entirely satisfactory.

SOURCES OF INFESTATION

The species of mites encountered in the present study were all members of the family *Thyroglyphidae* which inhabit various kinds of stored food products, the roots, bulbs, rhizomes etc. of living plants, particularly those with fungous lesions, and also aerial parts of plants, where these support fungi or lichens. All such materials which are brought into most laboratories almost daily probably constitute the main source of infestation of fungous cultures. Another, and not uncommon, source of infestation is the exchange of cultures between laboratories. In our study of the genus *Fusarium* we found that about twenty five percent of the cultures received from various parts of the world were infested with mites. A third source of infestation is the common house fly, and perhaps other winged insects, which carry these mites in their migratorial (hypopial stage) (**1**, **5**). We have repeatedly found both the hypopial and the adult stages on house flies.

ELIMINATION OF MITES FROM INFESTED CULTURES

Sanitary measures are undoubtedly salutary everywhere and particularly so in biological laboratories, i.e. material brought in should be disposed of quickly and not be allowed to lie around until it dries out sufficiently to compel the fauna on it to seek fields more compatible with their requirements for moisture and food. The statement of Thom (**15**:49) however seems to be much to the point: "Entire elimination of mites by sanitary measures is possible but not usually attained."

Fumigation, as a means of ridding cultures of mites, has perhaps received most attention (**4**, **7**, **8**, **9**, **10**, **11**) but has nevertheless not solved the problem. The mites involved are without tracheae and therefore are not very susceptible to gases. For this reason gases to be effective must be of such concentration that they usually prove to be toxic to the fungi and frequently noxious to the operators applying them. Of the various substances tested pyridine (**7**) appears to have been the most suitable, apparently being lethal to mites in concentrations that are only slightly toxic to the fungi tested (*Penicillium* and *Aspergillus*). Pyridine has been used on many other fungi with varying success. More recently advantages have been claimed for p-dichlor-benzene (**4**, **9**) as a fumigant.

Mites may be eliminated with greatest safety by subculturing to water agar or acid nutrient agars in petri dishes to discourage development of bacteria which are frequently found in mite infested cultures. Later transfers are made from the margins of the plate cultures or from hyphal tips. A still better method is to make several single-spore cultures from each infested tube, as this insures purity of the culture, that is, freedom from contaminating microorganisms as well as mites. Elimination of mites from infested cultures however is only a minor step in the control of these pests. The real control consists in keeping them out. The problem has been covered well by Smith (**12**: 211–16).

PROTECTION OF CULTURES BY BARRIERS

The water barrier for the exclusion of mites has probably been in use for the longest period of time. Its application has been recommended by Barnes (**2**). This method consists simply in placing

wire baskets of cultures on a pedestal in a pan of water. Such a barrier is quite effective against pedestrian mites but not at all against those possibly carried on the hands and clothing of the worker (**15**), nor against those carried by flies and other winged insects (**12**). Also, if a single tube happens to be infested all cultures within the barrier will soon be invaded. This is a weakness characteristic of group protection as against individual protection, which latter, if successful, automatically protects the group.

Chemical barriers have also been advocated from time to time and are still in use. The chemical barrier has the merit of protecting each individual tube against infestation. It consists in treating the cotton plugs or the insides of the rims of test tubes with a chemical that is toxic to the mites. That these chemicals are also toxic to fungi is indicated in the fact that those who advocate their use (**3**, **10**, **11**, **15**) also stipulate that the chemicals should not be applied until the culture is fully grown or nearly so. Aside from the serious disadvantage of the deleterious effect on fungi of these chemicals their application is somewhat tedious.

Tanglefoot barriers were developed and used by us in an attempt to avoid or eliminate the toxic effect of the chemicals on the fungi (Fusaria) with which we were working. The mechanism consists of small brass wire clasps for holding and supporting the tubes. The clasps are soldered onto screws which are screwed into strips of plywood board to within about 3 mm. of the base of the clasp. The exposed 3 mm. length of the screw is then covered with tanglefoot which constitutes the barrier. The strips are then fastened in drawers as shown in figure 1, *C*. This method has an advantage over the water barrier in that it gives individual protection rather than group protection against pedestrian mites, but, as with the water barrier, it does not protect against mites carried on hands and clothing of workers nor against those which are carried by winged insects.

The cigarette paper barrier across the mouth of the test tube was devised and developed in our laboratory more than six years ago (**6**). It has been used constantly since then and has given unqualified satisfaction. The method is based on the positive exclusion of the mites from each test tube culture by mechanical means. The materials to be used are shown in figure 2. They

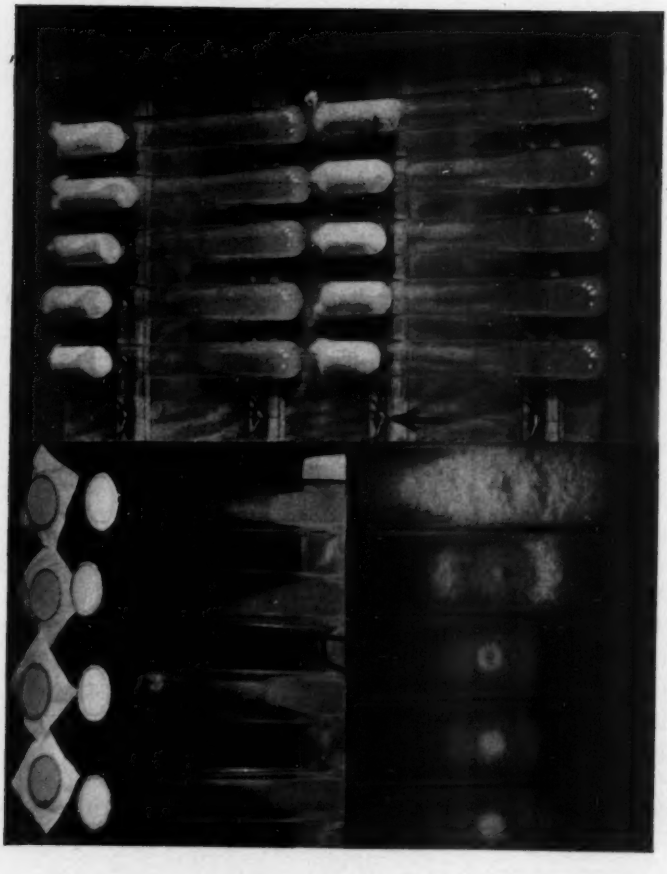

FIG. 1. *A*. Paper seals before and after margins have been removed by burning. *B*. The effect on fungal growth of various capping materials. From left to right: Parafilm, Celloseal, Fingerstall, Cellophane and Cigarette paper. *C*. Illustrates tanglefoot barriers. Arrow points to tanglefoot below metal clasp.

consist of: (*a*) 20 per cent gelatin in water to which has been added 2 per cent $CuSO_4$ to prevent fungal and bacterial growth, (*b*) a book of cigarette papers—preferably the L. L. F. brand which is also known as Riz La Croix, and (*c*) a heavy blotter such as is commonly employed in a plant press. About 25 cc. of the melted gelatin and $CuSO_4$ mixture are poured into a petri dish and allowed to solidify. The cigarette papers are taken from their cover, the small dab of glue that holds the sheets together is trimmed off and the bundle of sheets is cut in half. The cut papers are placed in a petri dish and may be sterilized in the dry oven. This treatment with dry heat tends to make the papers separate more easily and is necessary should the cotton plug be discarded at the time of sealing a tube.

After a culture has been made by the usual procedure the cotton plug is pushed down inside the tube well below the rim which is then flamed. The tube is held upside down and the flamed rim is pressed gently with a rotary motion against the surface of the solidified gelatin until it is coated with a thin film of the melted gelatin. Then the gelatin-coated rim is placed against the cigarette papers in the petri dish so that the top sheet adheres to the rim and is thus neatly picked up. It is made to adhere tightly to the rim by pressing it firmly against the resilient surface of the blotter. The tube is now placed upright in a rack with other tubes similarly prepared and so arranged that the corners of the projecting pieces of paper touch each other as shown in figure 1, A. When ignited at a single point, the projecting paper on all the tubes will burn off and leave neat, circular paper seals that effectively keep out all mites, spores and other contaminants and which also maintain the cotton plugs free from accumulations of dust.

When sub-cultures are to be made the seal is easily burned off by flaming, and after the transfer is completed the tube may be sealed again.

For cultures in liquid media the rim is flamed and the gelatin plate inverted and the gelatin surface pressed against the hot rim of the tube or flask, after which the cigarette paper is picked up by forceps and placed on the gelatin coated rim.

This cigarette paper barrier is so efficient that cotton plugs need

effect on fungal growth of various capping materials. From left to right: Parafilm, Celloseal, Fingerstall, Cellophane and Cigarette paper. *C*. Illustrates tanglefoot barriers. Arrow points to tanglefoot below metal clasp.

FIG. 2. Materials required for capping with cigarette paper. Also uncapped tubes, tubes capped without plugs, and tubes capped with plugs shoved below the rims.

only be used to keep the medium sterile until it is seeded (FIG. 2). We, however, prefer the double insurance of both paper and plug.

We have tested several brands of cigarette papers, many other kinds of paper, several grades of cellophane and other materials. All cellophanes and treated papers such as waxed papers greatly depressed growth of the fungi (FIG 1, *B*). Of the various papers tried only a certain type of white cigarette paper was found satisfactory, such as is represented by the L. L. F. (Riz La Croix), Tip Top, OCB, and Black Sea brands. Of these the L. L. F. paper was best because it leaves the least ash when burned. Other papers tested failed to make a perfect seal because of unsuitable weight or porosity, or were undesirable because they burned with an excessive or undesirable residue.

This new method of mite control has a number of advantages over older methods. The principal one is that it really "works"; there are no fumes toxic to the fungi and annoying to the operator; the materials are readily available, inexpensive, and easily applied.

FIG. 2. Materials required for capping with cigarette paper. Also uncapped tubes, tubes capped without plugs, and tubes capped with plugs shoved below the rims.

SUMMARY

A method to exclude mites and other contaminants from test tube cultures is described. It consists in covering the mouths of the tubes with cigarette paper which is applied by pressing the flamed rim of the tube against solidified gelatin (20 per cent gelatin in a 2 per cent solution of $CuSO_4$) and then against the cigarette paper. Excess paper is removed by burning.

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ELSINOË DISCOVERED ON SESBANIA AND CINNAMOMUM IN THE UNITED STATES

DONALD P. LIMBER, FLORA G. POLLACK, AND ANNA E. JENKINS

(WITH 3 FIGURES)

Examination of plant-disease specimens collected by inspectors of the Bureau of Entomology and Plant Quarantine during the insect and plant disease survey conducted in the general vicinity of ports of entry (1943–1945), revealed the existence of two species of *Elsinoë* Racib. (**5**), both undescribed. As noted elsewhere (**4**) one of these two pathogenic species, discovered in South Carolina, produces lesions on aerial growth of *Sesbania exaltata*, sometimes used as a green manure crop (**1**: 681); the other, found in Mississippi, produces a leaf spot and, less often, inconspicuous stem lesions on camphor-tree (*Cinnamomum camphora*), planted in the Southern States as a street tree (**1**: 178).

The *Elsinoë* on *Sesbania* was identified by Limber, and the one on *Cinnamomum* by Pollack. Following verification of these findings, Jenkins suggested that a joint study leading to the description of the two species be undertaken.

ELSINOË ON SESBANIA EXALTATA

On *Sesbania*, lesions are most conspicuous on stems, forming raised cankers reaching 2–5 mm. long by 1–3 mm. wide (FIG. 1, A). By confluence lesions may surround the stem more or less completely, causing an appreciable thickening, and extend as much as 10 cm. When young the lesions are smooth and only slightly elevated, but they soon become corky cankers, with the surface variously roughened, fissured, or pitted. They are generally drab in contrast to the normal brown color of the stem. Ascomata appear as dark specks on the surface of the cankers.

Viewed from above, ascomata are circular to elliptical. They are subcuticular to subepidermal, becoming erumpent. In section as-

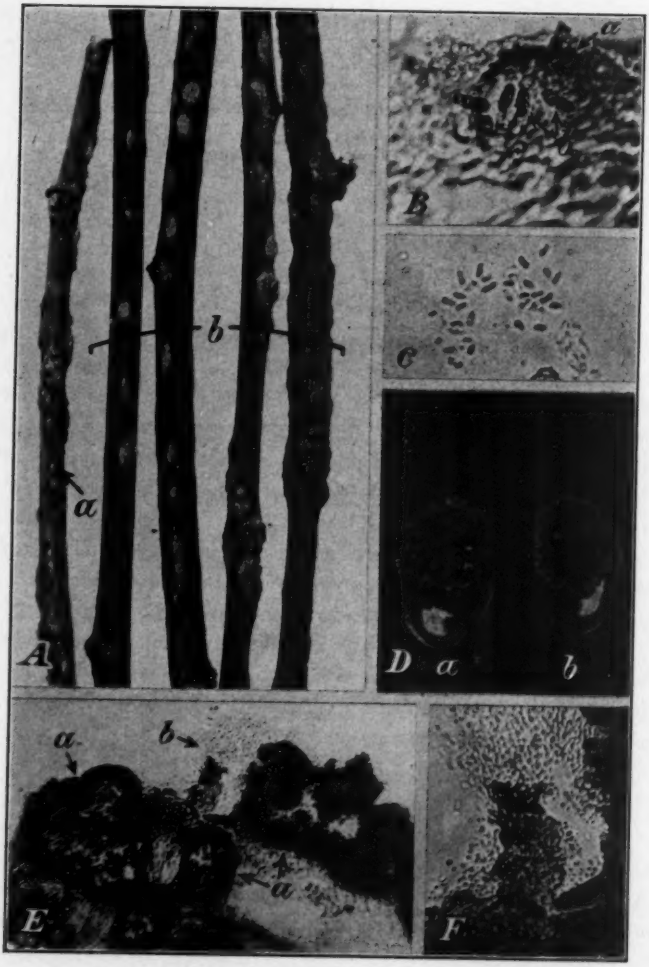

FIG. 1. *Elsinoë* on *Sesbania* and *Cinnamomum*.

comata are ovoid to subglobose (46–75 × 14–40 μ), often confluent and composed of small, irregularly shaped, pale olivaceous cells with a thin brown epithecium (FIG. 1, B). Asci are eight-spored, few to numerous, often compact in the ascomata, and globose to

ovoid (11.5–16 × 11.5–15 μ). Ascospores are hyaline, uniseptate to triseptate, usually the latter, constricted at the septa, most strongly at the median septum, and subclavate to oblong with rounded ends. In outline they are often straight on one side and curved on the other (10–12 × 3.5–4.5 μ) (FIGS. 1, B, *b*, and 3, A).

Acervuli of the *Sphaceloma* stage often occur with the ascomata. They are poorly defined, consist of a dense palisade of pointed conidiophores (4–7 × 1.5–2 μ), and produce hyaline, oblong-ellipsoid conidia which measure 3.5–6 × 1.5–3.5 μ (FIG. 1, C).

The *Elsinoë* was cultured from stem cankers collected at Levy, South Carolina, in October 1944. The fungus grew readily on various media, including Thaxter's [1] (FIG. 1, D, *a*), and potato-dextrose agar (FIG. 1, D, *b*). The month-old cultures on Thaxter's were "cinnamon" [2] to darker, bordered with "cinnamon buff." Corresponding cultures on potato-dextrose agar were "cinnamon brown" bordered by "honey yellow." Conidia and conidiophores were produced in culture (FIG. 3, B, *a* and *b*). As illustrated (FIG. 3, B, *b*), the conidiophores were subulate, subhyaline with granular contents, and constricted where septa were to form.

Elsinoë sesbaniae Limber and Jenkins sp. nov.

Maculae generaliter cinereae, in foliis inconspicuae, plerumque in nervis, in petiolis fructibusque, numerosae, prominentes; cancri in caulibus ex orbicularibus ellipticales, plani ad elevati, suberoso-rugulosi, rimosi, 2–5 × 1–3 mm., conspersi, aggregati, vel coalescentes et caulem usque ad 10 cm. cingentes; ascomata subcuticularia ad subepidermalia, parum exposita, ex ovatis subglobosa, pseudoparenchymatica, dilute olivacea, epithecio tenui fuscoque, 46–75 × 14–40 μ, interdum coalescentia; ascosporae hyalinae, 1–3 septatae, saepius triseptatae, ad septum constrictae, 10–12 × 3.5–4.5 μ; acervuli indeterminati, conidiophoris subulatis, subhyalinis, 4–7 × 1.5–2 μ, in palum compactum dispositis; conidia oblongo-ellipsoidalia, continua, hyalina, 3.5–6 × 1.5–3.5 μ.

DISTRIBUTION: On stems and pods, inconspicuous on leaves, of *Sesbania exaltata* (Raf.) Cory (Leguminosae), causing scab of *Sesbania*, South Carolina, U. S. A.

[1] For formula of Thaxter's potato agar see Bitancourt and Jenkins, 3, footnote 12.

[2] Names of colors in quotation marks are according to *Color Standards* and *Color Nomenclature*, by Robert Ridgway (1912).

SPECIMENS EXAMINED:[3] Charleston, South Carolina, October 28, 1943, A. W. Blizzard *565* (Type, in Mycological Collections *74693*); Levy, South Carolina, October 5, 1944, L. A. Mayer *1211*, and December 14, 1944, L. A. Mayer *1211A*.

ELSINOË ON CINNAMOMUM CAMPHORA

Lesions have been observed on the leaf blade and petiole, and to a lesser extent on the stem. The first indications of infection on the leaf are small, inconspicuous pale brown spots. These increase in size and may reach 3 mm. in diameter, and on the upper surface become raised, shiny, amber, spots which gradually turn black, and frequently become surrounded by a pale yellow halo (FIG. 2, A and B). The spots occasionally develop white centers, which may be surrounded by raised black ascomata (FIG. 2, E and G). On the lower surface the spots tend to be duller, spreading, and often confluent, and have few ascomata (FIG. 2, H). On both surfaces the lesions become elongate on the veins (FIG. 2, F). Occasionally spots fall out, giving the leaf a shot-hole appearance. Stem lesions, few in number, are dark brown areas that have split open and show white where the epidermis is raised and ruptured.

Sections of diseased areas in the leaf revealed ascomata containing asci and spores. Acervuli were poorly defined and no spores were present. In 1944 attempts were made to isolate the fungus. Cultures gave only rapidly growing associated fungi. Fresh material was received in 1945 and isolation again attempted. This time, after surface sterilization of the leaves, portions about 0.25 of an inch in diameter bearing mature ascomata were cut out and glued to the lid of a Petri dish. The lid was then placed over a plate of corn-meal agar. The plate was allowed to stand for 24 hours and then the lid was rotated about 15 degrees. After 24 hours more had elapsed, the lid was replaced by a sterile one. Within a week it was apparent that ascospores had been shot from both positions of the lid, for typical *Elsinoë* colonies developed on

[3] The specimens cited in this paper have been divided so that part of each is in the Mycological Collections of the U. S. Bureau of Plant Industry, Soils, and Agricultural Engineering, Beltsville, Md., and part in the herbarium of the U. S. Bureau of Entomology and Plant Quarantine, Hoboken, N. J.

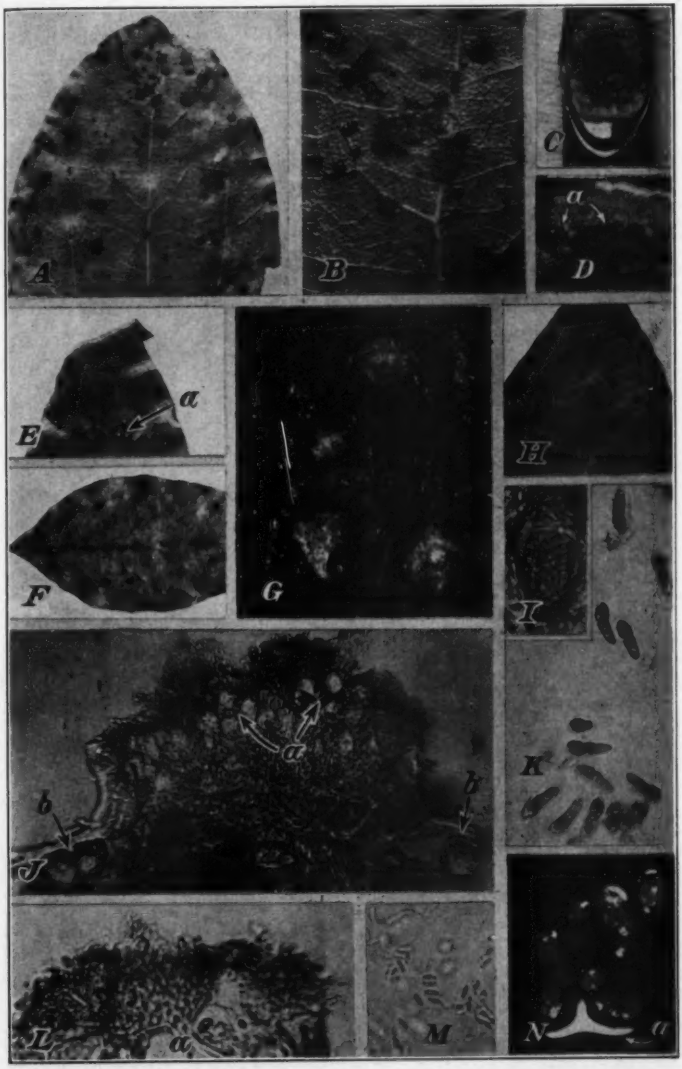

FIG. 2. *Elsinoë* on *Sesbania* and *Cinnamomum*.

corresponding areas of the agar surface below (FIG. 2, N). These colonies from individual ascospores were used for all subsequent studies.

Seven colonies from single-ascospore isolates were transferred to tubes of Thaxter's agar in April 1945. They grew slowly and, although the growth was thick and velvety, no spores were formed. Color changes of the thalli and in the medium were marked. The medium turned black and the colonies brick red. Several transfers were made to corn-meal agar, and when examined on June 1, 1945, conidia and conidiophores of the *Sphaceloma* stage were found (FIGS. 2, M and 3, E). Since then this stage has been observed in cultures on corn-meal agar ranging in age from one week to two and one-half months. In addition to this development, which was acervular to hyphomycetous, a second stage in the life cycle of this *Elsinoë* developed in cultures from single-ascospore isolates. This is here referred to tentatively as a pycnidial stage. It developed readily on corn-meal, slowly and sparsely on Thaxter's, and not at all on potato-dextrose agar. Transfers were made from vigorous corn-meal agar cultures producing pycnidia to potato-dextrose agar. The subsequent growth on potato-dextrose agar was typical of this fungus on this substratum, but no pycnidia were produced. On corn-meal agar masses of coalesced black pycnidia could be observed with the naked eye (FIG. 2, C, and D). In some corn-meal agar cultures both stages were present at the same time, but the pycnidial form was usually more abundant and conspicuous. At other times only the pycnidial form was present. In Thaxter's agar, for example, no conidia were observed. The pycnidial stage, however, developed on this medium in tubes that were two or more months old.

On all media tried the fungus exhibited pronounced chromogenic capacity, turning Thaxter's agar deep wine-color and then black, potato-dextrose agar black, and corn-meal agar brownish red and green.

The pulvinate ascomata, variable in size (up to 500 μ in diameter $\times$ 40–80 μ in height) (FIG. 2, J), are usually subepidermal, sometimes subcuticular or intraepidermal, and composed of small, olivaceous pseudoparenchymatous cells. The ascomata contain few to numerous asci scattered irregularly in the stromatic tissue, are

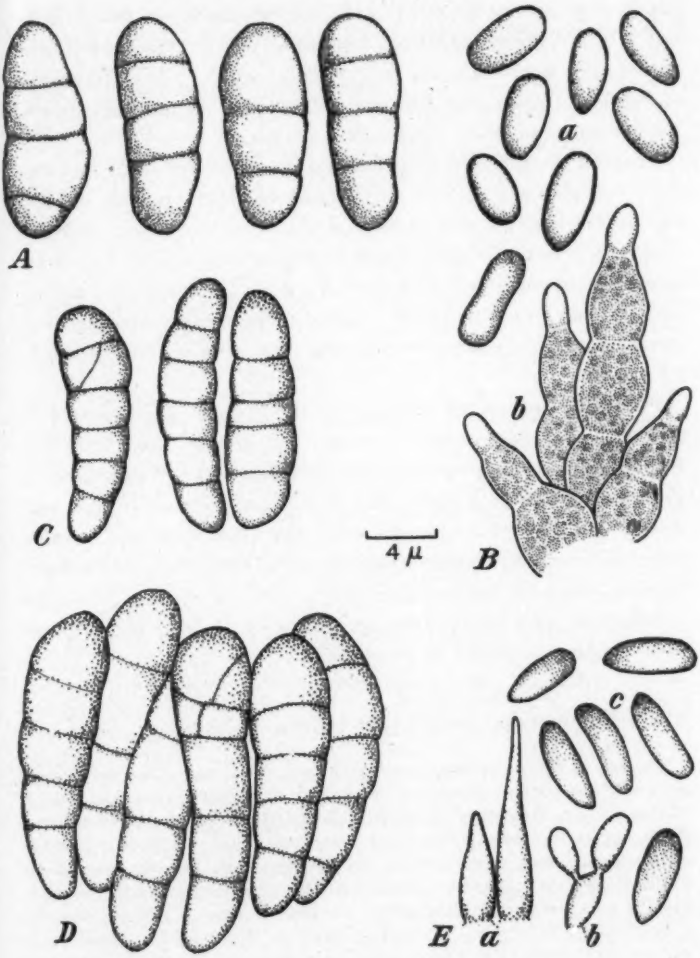

FIG. 3. *Elsinoë* on *Sesbania* and *Cinnamomum*.

frequently crowded, and with walls touching. The asci are globose to ovoid (20–36 × 12–20 μ) (FIG. 2, I), and become elongated 48 × 8 μ) in water upon rupture of the inelastic outer wall. They are filled with eight clavate, hyaline ascospores (15–17 ×4–6 μ),

usually four to five septate, which become muriform (FIGS. 2, K and 3, C). The longitudinal septum is usually in one cell, but occasionally more cells will be vertically septate. The ascospores are usually curved and deeply constricted at the middle septum, and are surrounded by a gelatinous envelope.

Acervuli are inconspicuous, being present on the same spots as the ascomata (FIG. 2, L). In a moist chamber acervuli develop into protruding fan-shaped sporodochia composed of a palisade layer of amber conidiophores and an amber pseudoparenchymatous base. Conidia were not observed on lesions, but when produced in culture from single-ascospore isolates these conidia were hyaline, oblong-ellipsoid, typically biguttulate, and continuous (4–6 × 2–3.5 μ).

Pycnidia originate as swellings in the hyphae, as illustrated in the case of *Elsinoë australis* Bitanc. and Jenkins (2, pl. 7, E). These swellings are greenish at first, blacken with age (and may be 20 μ in diameter or larger), and finally become thick-walled and septate (FIG. 1, E). On corn-meal agar they coalesce, forming large black masses with the limits of an individual body obliterated. Hyaline, ellipsoid, bacteria-like spores (1.8–2.5 × 0.5 μ), greenish in mass, are produced in the pycnidia (FIG. 1, F); these spores have not been observed to germinate.

Elsinoë cinnamomi Pollack and Jenkins sp. nov.

Maculae in foliis amphigenae, usque 3 mm. diam. parcae vel numerosae, superne conspicuores, plerumque succineae, nigrescentes, interdum centro albidae, margine frequenter lutescente; ascomata pulvinata, usque 500 μ diam., 40–80 μ crassa, interdum coalescentia; asci saepe numerosi, 20–36 × 12–20 μ; ascosporae clavatae, hyalinae, 4–5 septatae, cum una vel pluribus cellulis longitudinaliter septatis, ad septum centralem constrictae, saepe curvatae, 15–17 × 4–6 μ; acervuli indeterminati expositi; conidia in culturis, hyalina, oblongo-ellipsoidea, saepe biguttulata, continua, 4–6 × 2–3.5 μ; pycnidia in culturis nigra, variabilia, coalescentia; pycnidiosporae ellipsoideae, hyalinae, 1.8–2.5 × 0.5 μ.

DISTRIBUTION: On leaves, including petioles, and young stems of *Cinnamomum camphora* (L.) T. Nees and Eberm. (Lauraceae), causing scab of camphor-tree, Mississippi, U. S. A.

SPECIMENS EXAMINED: Ocean Springs, Miss., January 21, 1944,

L. A. Mayer *525;* January 22, 1944, A. W. Blizzard *1118*; March 16, 1945, Mayer *525A* (Type, in Mycological Collections *90137*).

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BELTSVILLE, MD.

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EXPLANATION OF FIGURES

FIG. 1. A–D, *Elsinoë sesbaniae* on *Sesbania exaltata.* A, cankered stems; *a*, from A. W. Blizzard 565; *b*, from L. A. Mayer 1211A, × 1. B, section of ascoma embedded in tissue of canker, from Blizzard 565; *a*, epithecium; *b*, ascospores, × 600. C, conidia, from Mayer 1211, × 600. D, Month-old cultures from Blizzard 565; *a*, on Thaxter's medium; *b*, on potato-dextrose agar, × 1. E and F, *Elsinoë cinnamomi* on *Cinnamomum camphora.* E, *a*, vertical section through pycnidial developments on the surface of an old culture; *b*, pycnidiospores, × 260. F, same as E, *b*, × 570. Photographs A and D by R. L. Taylor and B, C, E, and F by Limber.

FIG. 2. *Elsinoë cinnamomi* on *Cinnamomum camphora.* A, spots on upper surface of specimen Blizzard 1118, × 1. B, part of A, × 3½. C, culture from single ascospore on Thaxter's medium, dark masses of pycnidia visible on surface, × 1. D, *a*, pycnidial masses on the upper part of C, × 3½. E and F, leaf spots on Mayer 525A, × 1. G, same as E, showing numerous black ascomata on marginal zone of the four white-centered spots, × 14. H, spots on lower surface of a leaf of Mayer 525A somewhat obscured by a secondary dark hyphomycete, × 1. I, ascus with ascospores, × 570. J, ascoma from Mayer 525A in section; *a*, asci; *b*, upper epidermis of leaf, × 260. K, ascospores, × 570. L, somewhat indefinite stromatic mass, representing conidial (*Sphaceloma*) stage of *Elsinoë*, × 570. M, conidia from an old culture,

× 570. N, ten-day-old colony, individual thalli marking the position of the discharged ascospores; *a*, high lights indicating copious, viscid, transparent substance covering the thalli and spreading beyond, × 10. Photographs (A–H and N) by Taylor and (I–M) by Limber.

FIG. 3. A and B, *Elsinoë sesbaniae*. A, ascospores. B, *a*, conidia, and *b*, conidiophores produced in culture. C–E, *Elsinoë cinnamomi*. C, ascospores free from ascus. D, ascospores as grouped in ascus. E, *a*, conidiophores, *b* and *c*, conidia produced in culture, *b*, conidium bearing two secondary conidia. (A, B, D and E 4.3 mm. = 1 μ; C, 3.5 mm. = 1 μ.) Drawings by Limber.

PHOTOGRAPHS AND DESCRIPTIONS OF CUP-FUNGI—XLI. CATINELLA NIGRO-OLIVACEA

FRED J. SEAVER

(WITH 1 FIGURE)

One of the widely distributed, frequently collected, easily recognized, much named, and probably the most kicked around species of inoperculate cup-fungi is the species which forms the subtitle of the present paper. Specimens have been collected from Manitoba to Newfoundland, south to Louisiana, Alabama and the islands of Jamaica and Cuba. It has been described under at least nine different specific names and placed in eleven different genera, finally, very fittingly, made the type of a new genus by Boudier.

It has been illustrated several times in Europe but, so far as the writer is aware, never before in this country. A description and synonymy were presented by E. J. Durand (Bull. Torrey Club **49**: 15–20. 1922). Durand regarded this as one of the Patellariaceae but the writer does not so consider it. It would seem to belong more properly with the Mollisiaceae although that family itself is not very clearly defined. The following is the writer's conception of the genus and its type species:

CATINELLA Boud. Hist. Class. Discom. Eur. 150. 1907.

Apothecia patellate or nearly so, dark greenish, subgelatinous; asci cylindric or subcylindric, 8-spored; spores simple, greenish; paraphyses filiform, granular within.

Type species, *Peziza olivacea* Fr. *ex* Batsch, Syst. Myc. **2**: 142. 1822.

CATINELLA NIGRO-OLIVACEA (Schw.) Durand, Bull. Torrey Club **49**: 16. 1922.

? Peziza olivacea Batsch, Elench. Fung. 127. 1783.
Peziza nigro-olivacea Schw. Schr. Nat. Ges. Leipzig **1**: 121. 1822.

Patellaria pulla nigro-olivacea Fries, Syst. Myc. **2**: 160. 1882.
Bulgaria nigrita Fries, Elench. Fung. **2**: 16. 1830.
Lemalis rufo-olivacea Schw. Trans. Am. Phil. Soc. II. **4**: 184. 1832.
Rhizina nigro-olivacea Curr. Trans. Linn. Soc. **24**: 493. 1864.
Peziza viridiatra Berk. & Curt. Jour. Linn. Soc. **10**: 369. 1868.
Patellaria violacea Berk. & Br. Jour. Linn. Soc. **14**: 108. 1875.
Patellaria hirneola Berk. & Br. Jour. Linn. Soc. **14**: 108. 1875.
Patellaria applanata Berk. & Br. Jour. Linn. Soc. **14**: 108. 1875.
Peziza fuscocarpa Ellis & Holw. Jour. Myc. **1**: 5. 1885.
Patellaria olivacea Phill. Brit. Discom. p. 361. 1887.
? Humaria olivacea Sacc. Syll. Fung. **8**: 148. 1889.
Pezicula viridi-atra Sacc. Syll. Fung. **8**: 315. 1889.
Phaeopezia fuscocarpa Sacc. Syll. Fung. **8**: 474. 1889.
Bulgariella pulla nigro-olivacea Sacc. Syll. Fung. **8**: 638. 1889.
Bulgariella nigrita Sacc. Syll. Fung. **8**: 638. 1889.
Patinella violacea Sacc. Syll. Fung. **8**: 770. 1889.
Patinella olivacea Sacc. Syll. Fung. **8**: 770. 1889.
Patinella hirneola Sacc. Syll. Fung. **8**: 771. 1889.
Patinella applanata Sacc. Syll. Fung. **8**: 771. 1889.
Humaria marchica Rehm in Rab. Krypt.-Fl. 1^3: 952. 1894.
Phaeopezia marchica Sacc. Syll. Fung. **11**: 415. 1895.
Aleuria marchica Sacc. & Syd. in Sacc. Syll. Fung. **16**: 739. 1902.
Humaria fuscocarpa Morgan, Jour. Myc. **8**: 189. 1902.
Aleuria fuscocarpa Sacc. & Syd. in Sacc. Syll. Fung. **16**: 739. 1902.
Catinella olivacea Boud. Hist. Class. Discom. Eur. 150. 1907.

Apothecia sessile, solitary or several crowded together, attached to the substratum by numerous radiating dark-brown fibers more conspicuous in young plants, at first subglobose and closed, then expanding with a permanently upturned margin, at first entirely greenish yellow, becoming darker green, finally blackish with an olive tint, when old the exterior brownish and furfuraceous and vertically striate, fleshy and somewhat gelatinous when fresh, brittle when dry; reaching a diameter of 1 cm. but usually much smaller; mycelial fibers about the base very coarse, straight or strongly kinked, septate, dark-brown, reaching a diameter of 10 μ, radiating 2–3 mm. beyond the base of the apothecium; asci nar-

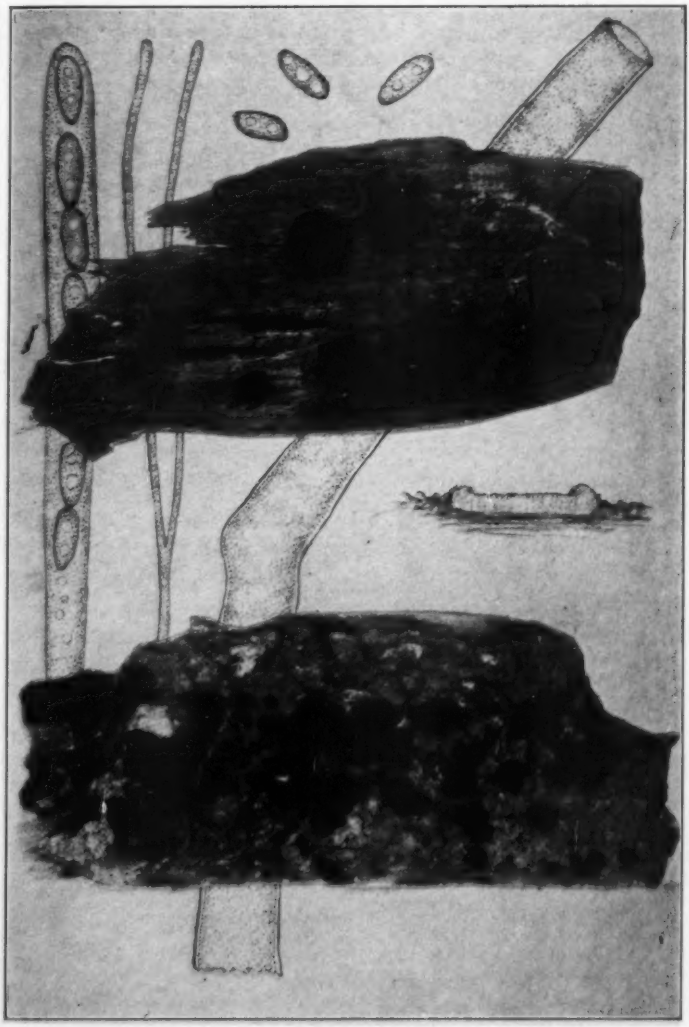

FIG. 1. *Catinella nigro-olivacea.*

rowly cylindric-clavate, 8-spored, reaching a length of 75–90 μ and a diameter of 5–6 μ; spores uniseriate, irregularly ellipsoid, often slightly constricted near the center so as to appear slipper-shaped, containing one or two oil-drops, pale olive, becoming brown, 4–5 × 7–10 μ; paraphyses cylindric, simple or rarely branched.

On rotten wood of various kinds.

TYPE LOCALITY: Europe.

DISTRIBUTION: Throughout eastern N. America, West Indies, and Ceylon; also in Europe.

ILLUSTRATIONS: Batsch, Elench. *pl. 12, f. 51;* Boud. Ic. Myc. *pl. 452;* Trans. Linn. Soc. **24**: *pl. 51, f. 10–12.*

EXSICCATI: N. Am. Fungi *2325:* N. Dak. Fungi *28.*

The species is easily recognized by its greenish apothecia and peculiarly shaped greenish spores.

EXPLANATION OF FIGURE

Above, photograph of apothecia on rotten wood, collected by W. A. Murrill in the island of Jamaica, about natural size. Below, photograph of rotten wood with apothecia from material collected in Nebraska by Leva B. Walker, about natural size. Left, drawing of ascus with spores and paraphysis. Right, diagram of a section of an apothecium. Center, drawing of a portion of hair from substratum.